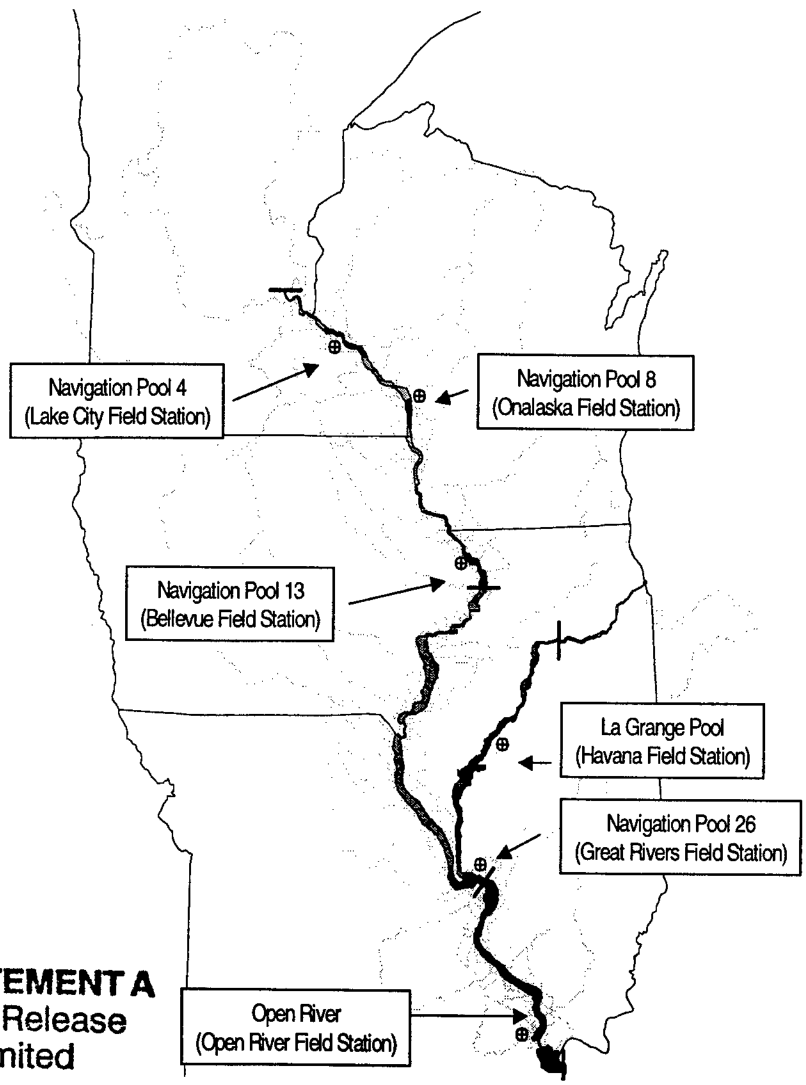
Long Term Resource Monitoring Program

# Technical Report
# 2001-T001

# Initial Analyses of Change Detection Capabilities and Data Redundancies in the Long Term Resource Monitoring Program






**September 2001**

*Long Term Resource Monitoring Program Technical Reports provide Long Term Resource Monitoring Program partners with scientific and technical support.*

*All reports in this series receive anonymous peer review.*

# Initial Analyses of Change Detection Capabilities and Data Redundancies in the Long Term Resource Monitoring Program

by

Kenneth Lubinski, Randy Burkhardt, Jennifer Sauer, David Soballe, and Yao Yin

U.S. Geological Survey
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

Project Completion Report
Project 6.1 (Analysis of Monitoring Designs)
Submitted to the
U. S. Army Corps of Engineers
Rock Island, Illinois

September 2001

Suggested citation:

Lubinski, K, R. Burkhardt, J. Sauer, D. Soballe, and Y. Yin. 2001. Initial analyses of change detection capabilities and data redundancies in the Long Term Resource Monitoring Program. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, September 2001. LTRMP 2001-T001. 23 pp. + Appendixes A–E

Additional copies of this report may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161 (1-800-553-6847 or 703-487-4650). Also available to registered users from the Defense Technical Information Center, Attn: Help Desk, 8725 Kingman Road, Suite 0944, Fort Belvoir, VA 22060-6218 (1-800-225-3842 or 703-767-9050).

# Contents

## Tables



## Figures

## Preface

The Long Term Resource Monitoring Program (LTRMP) was authorized under the Water Resources Development Act of 1986 (Public Law 99-662) as an element of the U.S. Army Corps of Engineers' Environmental Management Program. The LTRMP is being implemented by the Upper Midwest Environmental Sciences Center, a U.S. Geological Survey science center, in cooperation with the five Upper Mississippi River System (UMRS) States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. The U.S. Army Corps of Engineers provides guidance and has overall Program responsibility. The mode of operation and respective roles of the agencies are outlined in a 1988 Memorandum of Agreement.

The UMRS encompasses the commercially navigable reaches of the Upper Mississippi River, as well as the Illinois River and navigable portions of the Kaskaskia, Black, St. Croix, and Minnesota Rivers. Congress has declared the UMRS to be both a nationally significant ecosystem and a nationally significant commercial navigation system. The mission of the LTRMP is to provide decision makers with information for maintaining the UMRS as a sustainable large river ecosystem given its multiple-use character. The long-term goals of the Program are to understand the system, determine resource trends and effects, develop management alternatives, manage information, and develop useful products.

This report was prepared under Strategy 2.3.1, *Multi-component Syntheses* under Goal 2, *Monitor Resource Change* of the Operating Plan (U.S. Fish and Wildlife Service 1993). This report was prepared under Section 6.1, Analysis of Monitoring Designs, in the Scope of Work for Implementation of the Long Term Resource Monitoring Program Element of the Upper Mississippi River System–Environmental Management Program for Fiscal Year 2000. This report was developed with funding provided by the LTRMP. The purpose of the report is a first step in the evaluation of the adequacy and effectiveness of the LTRMP sampling designs.

# Initial Analyses of Change Detection Capabilities and Data Redundancies in the Long Term Resource Monitoring Program

by

Kenneth Lubinski, Randy Burkhardt, Jennifer Sauer, David Soballe, and Yao Yin

*U.S. Geological Survey, Upper Midwest Environmental Sciences Center*
*2630 Fanta Reed Road, La Crosse, Wisconsin 54603*

**Abstract**: Evaluations of Long Term Resource Monitoring Program sampling designs for water quality, fish, aquatic vegetation, and macroinvertebrates were initiated in 1999 by analyzing data collected since 1992 in six trend analysis areas. Initial emphasis was placed on evaluating statistical power to detect change from one year or sampling interval to the next, and on determining what spatial, methodological, or target variable redundancies existed in the data sets. Power to detect change was evaluated at halved, present, and doubled levels of effort. Power to detect change for different variables varied widely and was greatly influenced by sample size and for species by their frequency of occurrence. Power for detecting annual and seasonal changes in most water-quality variables seems adequate. A doubling of effort would provide little increase in power, and some reduction or redistribution of effort may be possible. For fish, we could detect a 20% change (at $\alpha = 0.05$ and power of 0.7) in annual mean catch-per-unit-effort for 41 species in at least one trend analysis area. Doubling effort would not appreciably enhance power for rare species. Power for detecting change in aquatic vegetation seemed adequate. However, power for detecting change in macroinvertebrates was low, especially in Navigation Pool 26, the Open River, and La Grange Pool. Results of these analyses should provide useful information for evaluating the effects of potential changes to sampling designs.

**Key words**: fish, Long Term Resource Monitoring Program, macroinvertebrates, Mississippi River, monitoring, power analysis, sampling design, statistical analysis, vegetation, water quality

## Introduction

Sampling of water quality, fish, aquatic vegetation, and macroinvertebrates through the Long Term Resource Monitoring Program (LTRMP, Program) has been under way at six field stations since 1992. Before 1999, Program analyses focused on subsets of data relevant to specific questions or hypotheses. In 1999, LTRMP staff began more comprehensive analyses to assess the scientific adequacy of the Program's databases. The objective of initial analyses performed in 1999 was to evaluate levels of statistical power and potential redundancies associated with the data compiled during the Program's early years. This report highlights major findings of these initial analyses.

Such analyses are desirable at regular intervals in any major monitoring effort to improve Program efficiency. The analyses done in 1999 were especially timely for the LTRMP for two reasons: (1) Short-term budget cuts were expected to reduce sampling intensity, and (2) the analyses were required to assess the potential loss of information associated with different cost-cutting strategies. At the same time, Congressional reauthorization of the LTRMP for an extended period was anticipated, and these analyses would be useful to guide future Program development.

This report examines the statistical adequacy exhibited by the LTRMP component databases. The analyses initiated in 1999 represent a first step toward critical analyses of the efficiency and scientific defensibility of the LTRMP.

## Monitoring Design

State and federal natural resource managers and scientists collaboratively developed the initial LTRMP monitoring design (Upper Mississippi River Conservation Committee 1980; Jackson et

al. 1981; U.S. Fish and Wildlife Service 1987), recommending a monitoring approach that was spatially and ecologically comprehensive and integrated (Upper Mississippi River Conservation Committee 1980). Integration included assessing physical, chemical, and biological elements and their responses to natural and human-induced impacts, all within similar locations (Jackson et al. 1981). From 1992 to 1999, the major components monitored by the LTRMP were water quality, fish, aquatic vegetation, and macroinvertebrates. Monitoring is presently conducted on five navigation pools (four on the Upper Mississippi River and one on the Illinois River) and an open-river area within the unimpounded reach of the Upper Mississippi River near Jackson, Missouri (Figure 1). These six areas are referred to in this report as the LTRMP Trend Analysis Areas.

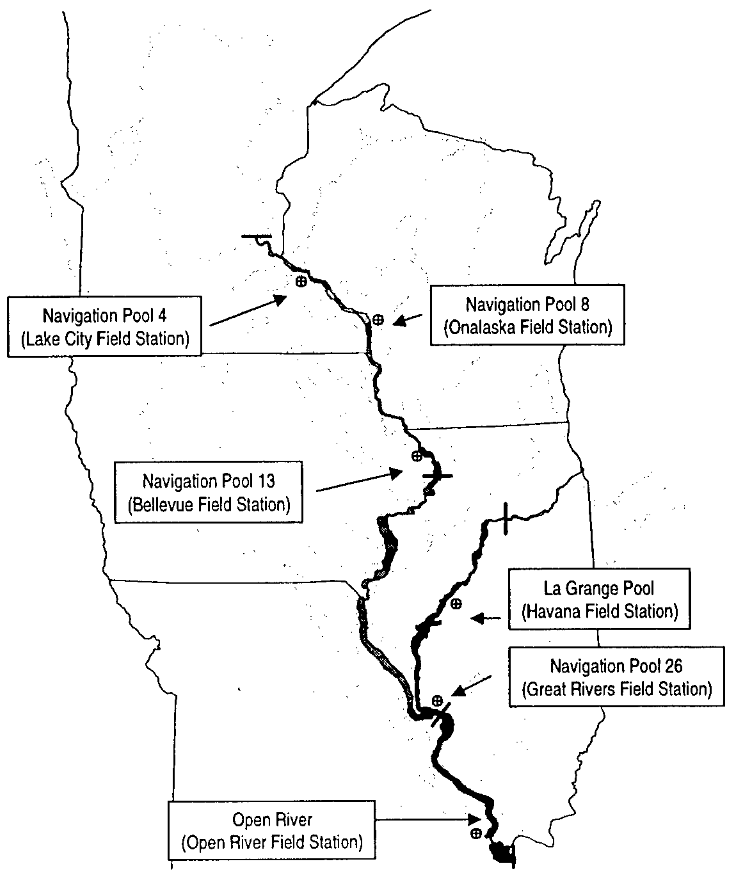



**Figure 1.** Long Term Resource Monitoring Program Trend Analysis Areas (*dark gray*) and their associated field stations (*symbol*). Black bars separate floodplain reaches that have different land cover features and human-use histories (U.S. Geological Survey 1999)

Initially, most sampling was done at fixed sites. Component designs now include fixed and random sampling sites, stratified by aquatic area categories (Wilcox 1993). Aquatic area categories are similar to traditional fish habitat types (Rasmussen 1979). The term "habitat" was considered an inappropriate label for these categories, which were intended to function primarily as mapping units, defined more by plan form features than by physical and chemical features or by species distribution data. Distribution of sampling sites across aquatic area categories differs by component and trend analysis area (Table 1). The absence of nonchannel habitats, for instance, in the Open River trend analysis area, restricted the location of sampling sites to channel categories.

River ecosystem conditions often depend on the hydrologic regime and can vary considerably within and among years in response to hydrologic variables. Thus, it is important that hydrologically controlled changes be distinguished from long-term changes resulting from human alterations of the river. Each LTRMP component was sampled at a time and frequency thought to best characterize its dynamics. Annual observations were considered a basic temporal element of the LTRMP. Additional criteria used to guide sample timing and frequency included minimizing random variation and maximizing sampling efficiency.

Sampling gears and methods were designed to effectively and accurately estimate target variables

**Table 1.** Types of sampling conducted historically within different aquatic area categories and trend analysis areas for each component of the Long Term Resource Monitoring Program. Aquatic area categories (Wilcox 1993) are hierarchical and represent different levels of spatial resolution. In the table heading, any single category is contained within all other categories that are listed to its left and higher within the heading. For example, the category of "Main channel border unstructured" is contained within "Main channel border," which is contained within "Main channel."

| | | Aquatic area categories | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Channel categories | | | | | | | | Backwater categories | | | | | | | |
| Component | Trend analysis area | Main channel | Main channel border | Main channel border unstructured | Main channel border wing dam | Main channel tailwater | Side channel | Side channel border | Tributary channel | Contiguous lake | Contiguous lake shoreline | Contiguous lake offshore | Contiguous impounded | Contiguous impounded shoreline | Contiguous impounded offshore | Contiguous delta lake[c] | Isolated |
| Water quality[a] | | | | | | | | | | | | | | | | | |
| | Pool 4 | SRS,BF | | | | | SRS,BF | | BF | SRS,BF | | | BF | | | SRS,BF | |
| | Pool 8 | SRS,BF | | | | | SRS | | BF | SRS,BF | | | SRS,BF | | | | SRS |
| | Pool 13 | SRS,BF | | | | | SRS,BF | | BF | SRS,BF | | | SRS,BF | | | | |
| | Pool 26 | SRS,BF | | | | | SRS | | BF | SRS,BF | | | SRS,BF | | | SRS,BF | BF |
| | Open River | SRS,BF | | | | | SRS,BF | | BF | | | | | | | | |
| | La Grange Pool | SRS,BF | | | | | SRS,BF | | BF | SRS,BF | | | | | | | BF |
| Fish[b] | | | | | | | | | | | | | | | | | |
| | Pool 4 | | | D,HL,HS,S,M | D,M,S,HL,HS | F,HS,HL,M,T | | D,HL,HS,S,M | | | D,F,M | D, X,Y,TA | | | | | |
| | Pool 8 | | | D,HL,HS,S,M,N | D,M,S,HL,HS | S,N,HS,HL,M,T | | D,HL,HS,S,M,N | | | D,F,M,S | X,Y,HL,HS | | D,F,M | HL,HS,X,Y | | |
| | Pool 13 | | | D,HL,HS,S,M,N | D,HL,HS,S,M,N | N,HS,HL,M,T | | D,HL,HS, S, M | | | D,F,M,S,N | X,Y | | D,F,M,S | HL,HS,X,Y | | |
| | Pool 26 | | | D,F,HL,HS,S,M | D,S,HL,HS | N,T | | D, F, M, HL, HS | | | D, F, M | X,Y,HL,HS | | D,F,M | HL,HS,X,Y,TA | | |
| | Open River | | | D,F,HL,HS,S,M | D,M,HL,HS, F | | | D,F,HL,HS,G,M | D,F,HL,HS,G,M | | | | | | | | |
| | La Grange Pool | | | D,HL,HS,S,M, | | D,S,N,HS,HL,M,T | | D,HL,HS,S,M,N | | | D,F,M,S | X,Y, HL, HS | | | | | |
| Aquatic vegetation[a] | | | | | | | | | | | | | | | | | |
| | Pool 4 | | SRS | | | | | SRS | | SRS,TRN | | | | | | | SRS,TRN |
| | Pool 8 | | SRS | | | | | SRS | | SRS,TRN | | | SRS | | | | SRS,TRN |
| | Pool 13 | | SRS | | | | | SRS | | SRS,TRN | | | SRS,TRN | | | | SRS,TRN |
| | Pool 26 | | SRS | | | | | SRS | | SRS,TRN | | | SRS | | | | SRS,TRN |
| | Open River | | | | | | | | | | | | | | | | |
| | La Grange Pool | | SRS | | | | | SRS | | SRS,TRN | | | | | | | SRS,TRN |
| Macroinvertebrates[a] | | | | | | | | | | | | | | | | | |
| | Pool 4 | | SRS | | | | SRS | | | SRS | | | | | | SRS | |
| | Pool 8 | | SRS | | | | SRS | | | SRS | | | SRS | | | | |
| | Pool 13 | | SRS | | | | SRS | | | SRS | | | SRS | | | | |
| | Pool 26 | | SRS | | | | SRS | | | SRS | | | SRS | | | | |
| | Open River | | SRS | | | | SRS | | | | | | | | | | |
| | La Grange Pool | | SRS | | | | SRS | | | SRS | | | | | | | |

[a]Sampling codes for water quality, aquatic vegetation, and macroinvertebrates are SRS = stratified random sampling; BF = biweekly fixed sampling; TRN = transect sampling.
[b]Sampling codes for fish are D = day electrofishing, F = fyke net, G = gill net, HL = large hoop net, HS = small hoop net, M = mini-fyke net, N = night electrofishing, S = seining, T = trawling, TA = anchored trammel net, X = tandem fyke net, Y = tandem mini-fyke net.
[c]Lake Pepin, in Pool 4, and Swan Lake, in Pool 26, are tributary delta lakes but are grouped with impounded areas for some analyses.

within each trend analysis area and aquatic area category. Consistency of methods within each aquatic area category, across all trend analysis areas, was considered an important aspect of the LTRMP. Descriptions of sampling methods for components were provided by Gutreuter et al. (1995), Soballe et al. (1995), Thiel and Sauer (1999), and Yin et al. (2000). More detailed information about sampling methods is included in the sections that follow when needed to evaluate power and redundancy issues.

## Analytical Methods

### *General Analytical Design*

#### Change Detection

We considered two options for evaluating the statistical ability of the present monitoring program to detect change over time. The first option was trend analysis. A trend analysis determines if a statistically significant trend is apparent in the data over time. Confidence in trend detection is influenced by the duration of monitoring and generally improves with time. The second option was evaluating change from one year to the next. In choosing between these options, we reasoned that it was less important for us to identify trends than it was to determine how well we could document an annual change at existing levels of effort. If we were collecting enough samples to successfully detect annual change, then we assume that we could adequately detect multiyear trends.

We used power analysis to assess how well we can detect change from one period to the next. Power analyses are more relevant to the early warning function of the LTRMP than are trend analyses. Power is defined as $1 - \beta$, where $\beta$ = Type II error, the chance of accepting (i.e., failing to reject) a false null hypothesis (Peterman 1990).

For evaluating LTRMP data, the typical null hypothesis assumed no change in a variable from one period to the next. Accepting a false null hypothesis would mean that a change did indeed take place between the periods, but that monitoring data failed to detect it. For example, consider a case in which dissolved oxygen, an important variable influencing the quality of aquatic habitats, declined between Year 1 and Year 2, but our data were insufficient to detect the change. Therefore, we would wrongly accept the null hypothesis. Greater power reduces the probability of missing such a change when it actually happens. However, the ecological and management significance of this "statistical mistake" would depend upon the magnitude of change and upon the true oxygen concentration relative to the needs of various aquatic organisms.

Several factors influence power, including the test procedure (model), significance level ($\alpha$), sample size, and effect size (Johnson 1999). For any given null hypothesis, test procedure, and significance level, power is inversely related to sample size, but the relation is not always linear. For these analyses, we were mostly concerned with the influence of sample size, a factor that can be easily modified by program managers. Thus, we estimated the power associated with the present level of sampling effort and at half and twice the present effort. Power at one half and twice the present effort was estimated by recalculating the sample variance to reflect a halving or doubling of sample size. Analyses were conducted using SAS statistical software and the procedures Corr, Expand, Insight, Means, GLM, and gPlot.

We conducted additional analyses when it seemed that greater flexibility was required to understand an emerging pattern. For instance, one analysis was conducted to explore how temporal changes in a defined habitat could be assessed with water-quality data.

#### Sampling Frequency

We also considered sampling frequencies needed to assess important ecological cycles of the target variables. Given sufficient time, the monitoring designs were intended to distinguish short-term from long-term variations and to allow

rapid detection of changes that have important ecological consequences.

Annual sampling has been a key aspect of the LTRMP temporal design; however, biological response variables can lag behind physical variables. In addition, annual variation may be relatively less important for organisms with long-life spans than for those with short-life spans. Long-term trends may be identifiable without annual sampling. A recent proposal for decreasing monitoring costs of the LTRMP suggested that multiyear sampling options be considered. A 3- or 5-year repeated sampling design similar to that used under the National Water Quality Assessment Program was offered as a potential option for some LTRMP variables. We explored potential advantages and disadvantages of multiyear sampling for macroinvertebrates, organisms with short-life spans.

## Evaluation of Data Redundancies

The three potential sources of data redundancy evaluated in 1999 were space, sampling gears, and target variables. Evaluations of spatial redundancies addressed several scales. The LTRMP monitoring design emphasizes patterns at three scales relevant to the ecology of floodplain rivers, floodplain reach, navigation pool, and habitat (Lubinski 1993). The initial siting of the LTRMP Trend Analysis Areas was based, in part, on differences in ecosystem structure and human use among several reaches of the Upper Mississippi River System. By using pool boundaries to delimit five of the six trend analysis areas, we acquired the ability to study and quantify within-pool structural patterns and longitudinal gradients associated with impoundment. The aquatic area classification scheme was established to test the perceived ecological distinctions among aquatic habitat types. Biweekly sampling of water quality at selected tributary mouths attempts to understand patterns at a fourth spatial scale, the stream network.

Three trend analysis areas (Navigation Pools 4, 8, and 13) are located in the Upper Impounded Reach of the Upper Mississippi River. One trend analysis area is located in each of three other floodplain reaches (Figure 1). Each monitoring component requires samples from multiple aquatic area categories (Table 1). The proportions of samples within each aquatic area category differ by component, and the proportions of aquatic area categories differ within each trend analysis area.

During discussions on downsizing LTRMP, proposals included various options for eliminating or reducing sampling in one or more trend analysis area or aquatic area category. The basic premise was that if two trend analysis areas or aquatic area categories yielded similar information, one could be considered for elimination from the design.

Similarities between trend analysis areas were evaluated using cluster analysis. Callahan (1998) noted that statistical procedures designed to test hypotheses and determine $p$-values are not appropriate for identifying similarities among trend analysis areas because these procedures tend to indicate that groups with high variance and small sample size are similar regardless of other attributes. Cluster analysis is not used to test hypotheses, but rather to sort and group observations. Hierarchical cluster analysis results are summarized in dendrograms. Each step of the hierarchical clustering algorithm is represented as a node on the dendrogram. The height of each node represents the similarity of the clusters being joined, and groups merged toward the bottom of a dendrogram are more similar than groups merged toward the top (Callahan 1998).

The cluster analyses and figures included in this report were selected because of their value in addressing potential informational losses associated with eliminating a trend analysis area or with redistributing effort within or among the trend analysis areas. Cluster analyses were performed using S-Plus statistical software (Venables and Ripley 1999). Distance measures for the clusters were Euclidian distances for the water-quality component, and correlation coefficients for other components.

The evaluation of gear or method redundancies in the LTRMP applies specifically to the fish and aquatic vegetation components. Fish were sampled

with a variety of gears intended to efficiently collect fish in the varying conditions found within each aquatic area category. Aquatic vegetation was sampled using two methods—transect sampling and stratified random sampling—the latter began in 1998. The question of target variable redundancies was directed primarily at the water-quality component.

## *Component Analyses*

### Water Quality

Between 1993 and 1996, water-quality monitoring was designed to yield information at several spatial and temporal scales (Table 1). Quarterly stratified random sampling addressed patterns at seasonal and annual temporal scales and at both trend analysis area and aquatic area category spatial scales. Biweekly, fixed-site sampling was designed to track fluctuations at temporal scales of a month or longer (e.g., as might be associated with substantial changes in river discharge). Fixed sites on selected tributaries, dams, or channel cross-sections were intended to monitor conditions associated with upstream drainages or reaches.

Water-quality variables that were measured *in situ* included dissolved oxygen, temperature, conductivity, turbidity, and Secchi disk transparency. Quantification of nitrogen, phosphorus, and suspended solids required laboratory analysis of water samples. Water samples for laboratory analysis were collected at half of the quarterly stratified random sites and at all of the biweekly fixed sites.

Two additional analyses were conducted using water-quality variables. A binomial approach was used to investigate our ability to detect annual changes in availability of overwintering habitat for sunfish. This approach is applicable to any study that involves estimating the frequency of occurrence of sites meeting certain criteria.

The second analysis was an autocorrelation of dissolved oxygen measurements to determine if LTRMP is oversampling with a biweekly schedule at fixed sites. The analysis used oxygen data from 42 sampling sites in the main channel, side channels, and tributaries. The analysis indicated how well an oxygen measurement at a given point in time could be predicted from an earlier measurement at the same location (autocorrelation). If one value can be predicted from another, then the two measurements are redundant. Oxygen is less variable than other constituents, thus if the frequency of oxygen sampling was not excessive, then we reasoned that other, more time-variant constituents, were not oversampled either.

### Fish

Multiple gears were used to sample fish from 1993 through 1999. The design was intended to evaluate the fish community within each LTRMP Trend Analysis Area, by relevant aquatic area category, as opposed to focusing on one or more individual species. Fish gears (Table 1) were selected based on the experience of fishery biologists to maximize sampling efficiency within different aquatic area categories.

In each year, fish were sampled during three periods: early summer (June 15–August 1); late summer (August 2–September 15); and fall (September 16–October 31). Fish catch-per-unit-effort (CPUE) was transformed with the $4^{th}$ root method to normalize the data and reduce the influence of zero catches.

### Aquatic Vegetation

Sampling along fixed transects for submersed and rooted floating–leaf vegetation was conducted from 1991 to 1998 in contiguous backwaters, isolated backwaters, and impounded areas (Table 1). No transects were established in the Open River trend analysis area because it lacks backwater and impounded habitat. Transect sampling was conducted twice per year, first in spring between May 15 and June 15, and again in summer between July 15 and August 15, in recognition of the changing dominance of plant species during the growing season.

To address additional questions about the occurrence of submersed and rooted floating–leaf

vegetation at the trend analysis area scale, an experimental stratified random design was implemented in 1998. Sites less than 3 m deep in main channel border, side channel border, contiguous backwater, isolated backwater, and impounded aquatic area categories were sampled (Table 1). To evaluate potential problems that might arise as a result of switching from transect to stratified random sampling, we compared species richness, species abundance, and community abundance results obtained from both methods in three backwaters during 1998.

### Macroinvertebrates

Macroinvertebrate sampling from 1992 to 1999 was based on a stratified random design in which samples were distributed within aquatic area categories believed to have soft (sand, mud, or sand-mud mixture) substrates. Nearby substitute sites were sampled when primary locations could not be sampled with a Ponar dredge because of aquatic vegetation or hard substrate (rocks, cobble, hard clay). In each trend analysis area, about 125 samples were collected annually. Samples were processed in the field. Data were recorded for five macroinvertebrate taxa, but initial analyses in 1999 were limited to mayflies (Ephemeroptera) and fingernail clams (Sphaeriidae).

Data on macroinvertebrate density were not normally distributed, and frequent zero values were recorded. To reduce the influence of these zero values on the analyses, we performed the initial power analyses on presence/absence of data.

## *Presentation of Results*

To link the discussion of the analyses initiated in 1999 to potential Program restructuring issues, results were grouped according to four discussion questions. This organizational and reporting approach was reviewed and approved by the LTRMP Analysis Team. The questions were as follows:

1. What ability do we have to detect change from one year or sampling period to another?
2. Are there spatial redundancies in the Program?
3. Are there gear or method redundancies in the Program?
4. Are there target variable redundancies in the Program?

The analyses treated the monitoring components as individual elements. Statistical analyses or graphic presentations were often repeated for multiple variables or species, at both trend analysis area and aquatic area category scales, and in the case of fish, for different gear types. Selected results were used to illustrate and summarize discussion points in the sections that follow.

Some reporting conventions were necessary, such as reporting power at halved, present, and doubled levels of effort across all components. Other conventions, such as fixed levels of $\alpha$ (alpha) for the power analyses, were used when feasible. We did not, however, adhere to strict reporting consistencies across all components if doing so would have forced us to present results that did not demonstrate the greatest sensitivity of response. We frequently (but not always) presented power results using $\alpha = 0.2$ because this value is commonly applied in monitoring programs in which the consequences of "sounding a false alarm" are deemed to be less worrisome than the consequences of failing to detect a "population decline" (Gibbs et al. 1998). We presented most power results in terms of detecting either a 20% or 50% change in the mean of a variable from one year or period to the next.

## Results

## *Question 1: What ability do we have to detect change from one year or sampling period to another?*

### Water Quality

Means and ranges of power estimates for 10 water-quality variables at halved, present, and doubled levels of effort calculated for all season-to-season changes are presented in Table 2. More

detailed results showing power for each water-quality variable by aquatic area category, trend analysis area, and season are presented in Appendix A.

At present levels of effort, power to detect a 20% change (at $\alpha = 0.2$) in seasonal means of variables measured *in situ* ranged from a low of 0.74 for turbidity to a high of 0.97 for conductivity (Table 2). Power (same conditions) to detect change of laboratory-measured variables ranged from 0.53 for soluble-reactive phosphorus to 0.83 for total nitrogen.

Halving the present level of effort would reduce power to detect change of *in situ* variables to a ranged of 0.60 for turbidity and a high of 0.94 for conductivity (Table 2). Halving the present level of effort would reduce power of laboratory-measured variables to a range of 0.43 for soluble-reactive phosphorus to 0.73 for total nitrogen.

Doubling the present level of effort would increase power to detect change of *in situ* variables to a range of 0.86 for turbidity and a high of 0.99 for conductivity (Table 2). Doubling the present level of effort would increase power of laboratory-measured variables to a range of 0.64 for soluble-reactive phosphorus to 0.91 for total nitrogen.

Autocorrelations of dissolved oxygen at the 42 fixed sites, for lags ranging from 1 week (statistically simulated) to 7 weeks are summarized in box-whisker plots (Figure 2). The coefficient of determination dropped rapidly beyond 2 weeks to below 50%. This rapid decrease suggested that the present biweekly sampling interval for fixed sites is appropriate to the design concept. A longer

**Table 2.** Means and ranges of power ($\alpha = 0.2$) for detecting a 20% change in seasonal means of 10 water-quality variables at three levels of effort. Power was calculated for all aquatic area categories and trend analysis areas from 1993 through 1996.

| Water-quality variables | Halved effort | Present effort | Doubled effort |
|---|---|---|---|
| **Measured *in situ*** | | | |
| *Dissolved oxygen* | | | |
| Mean power | 0.90 | 0.93 | 0.96 |
| Range | 0.14 - >0.99 | 0.16 - >0.99 | 0.19 - >0.99 |
| *Temperature* | | | |
| Mean power | 0.87 | 0.89 | 0.92 |
| Range | 0.13 - >0.99 | 0.14 - >0.99 | 0.16 - >0.99 |
| *Conductivity* | | | |
| Mean power | 0.94 | 0.97 | 0.99 |
| Range | 0.15 - >0.99 | 0.17 - >0.99 | 0.21 - >0.99 |
| *Turbidity* | | | |
| Mean power | 0.60 | 0.74 | 0.86 |
| Range | 0.15 - >0.99 | 0.17 - >0.99 | 0.20 - >0.99 |
| *Secchi disk transparency* | | | |
| Mean power | 0.77 | 0.88 | 0.94 |
| Range | 0.12 - >0.99 | 0.13 - >0.99 | 0.15 - >0.99 |
| **Measured in laboratory** | | | |
| *Total suspended solids* | | | |
| Mean power | 0.48 | 0.62 | 0.76 |
| Range | 0.12 - 0.99 | 0.12 - >0.99 | 0.13 - >0.99 |
| *Total nitrogen* | | | |
| Mean power | 0.73 | 0.83 | 0.91 |
| Range | 0.14 - >0.99 | 0.16 - >0.99 | 0.19 - >0.99 |
| *Nitrate/nitrite* | | | |
| Mean power | 0.60 | 0.69 | 0.78 |
| Range | 0.11 - >0.99 | 0.11 - >0.99 | 0.12 - >0.99 |
| *Total phosphorus* | | | |
| Mean power | 0.60 | 0.72 | 0.83 |
| Range | 0.11 - >0.99 | 0.11 - >0.99 | 0.13 - >0.99 |
| *Soluble reactive phosphorus* | | | |
| Mean power | 0.43 | 0.53 | 0.64 |
| Range | 0.11 - >0.99 | 0.11 - >0.99 | 0.11 - >0.99 |

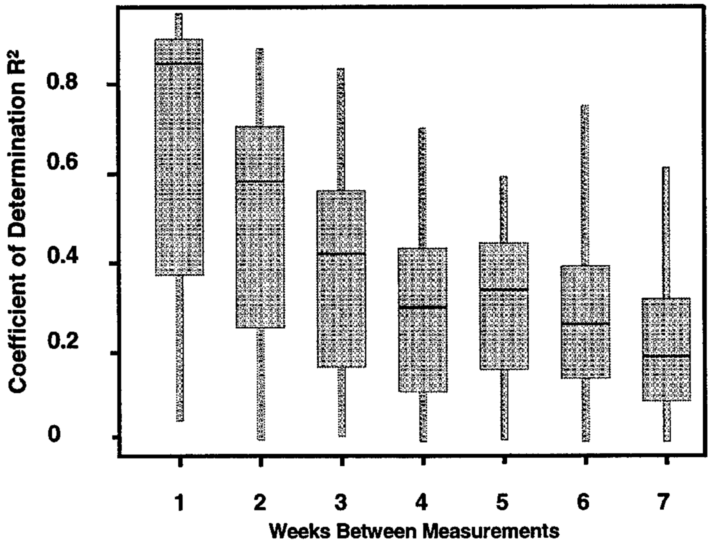



**Figure 2.** Autocorrelations of dissolved oxygen at the 42 fixed sites, for lags ranging from 1 week (statistically simulated) to 7 weeks. The box-whisker plots show medians, 25th and 75th percentiles, and ranges of coefficient's of determination.

sampling interval could be used to estimate an annual mean, but would increase the chance that large variations among samples could go undetected.

Previous analyses with a binomial approach based on 3 years of water-quality data from Navigation Pool 8 estimated that about 10% of the available backwater habitat was suitable overwintering habitat for sunfish (Soballe and Rogala 1996). With a sample size of 60 (the present effort) and an α of 0.2, power to detect a 20% change in the extent of this habitat among years is about 0.30 (Figure 3). Figure 3 can be used to estimate power for detecting a 20% change in the mean using other α levels and percent frequencies of defined habitat. If suitable habitat increased to 50%, the chance for more of the stratified random sites to fall into that area would increase, and the power to detect a 20% change would increase to around 0.61.

## Fish

Power analyses at the present level of effort within all sampled aquatic area categories and trend analysis areas were completed for all species. Table 3 presents gear and aquatic area category combinations that resulted in an ability to detect a 20% or 50% annual change in mean CPUE for 14 priority species identified by LTRMP partners: black crappie, bluegill, channel catfish, common carp, emerald shiner, freshwater drum, gizzard shad, largemouth bass, northern pike, sauger, smallmouth buffalo, walleye, white bass, and white crappie. (Scientific names of fish collected in LTRMP sampling are listed in Appendix B.) More detailed results showing power by trend analysis area, gear type, and aquatic area category at halved, present, and doubled levels of effort are presented in Appendix C. Power varied widely among species, depending on their relative abundance in the catches by gear type, aquatic area category, and trend analysis area.

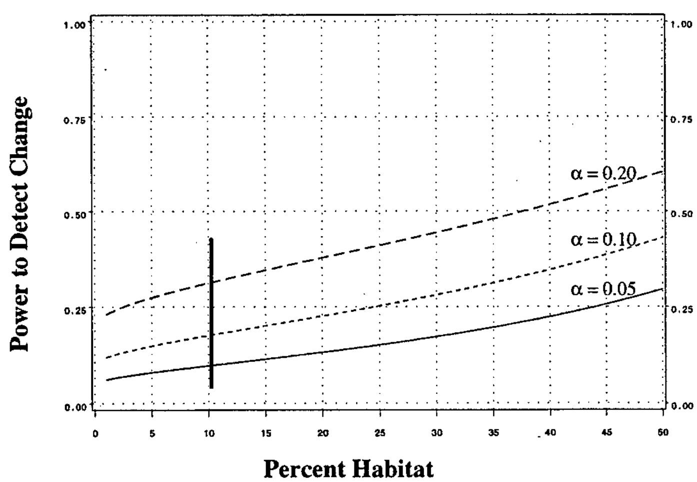



**Figure 3.** Power to detect a 20% change in the annual percentage of a specified habitat type. For example, the present extent of overwintering habitat for sunfish was estimated to be 10% of the available backwater in Navigation Pool 8. If the water-quality sampling effort for that strata remains the same (n = 60), change detection power will be about 0.10, 0.18, and 0.30 at α levels of 0.05, 0.10, and 0.20, respectively (*vertical line*).

**Table 3.** Power (at $\alpha = 0.05$) to detect annual change in mean catch-per-unit-effort (CPUE) for 14 fish species of special interest to partners in the Long Term Resource Monitoring Program (LTRMP). Only combinations of gears and aquatic area categories that resulted in a capability to detect a 20% or 50% change in CPUE are listed. Power values with a "<" or ">" sign indicate that power was greater than, or less than, the indicated value for all combinations of gear, aquatic area category, and trend analysis area within that row.

| Fish species | Power | Detected percentage of change in mean CPUE | Gear | Aquatic area categories[a] | LTRMP trend analysis area[b] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | P4 | P8 | P13 | P26 | OR | LG |
| Black crappie | >0.80 | 20 | fyke nets, tandem fyke nets | BWCS, BWCO | X | X | X | X | | X |
| Bluegill | >0.70 | 20 | fyke nets | BWCS | X | X | X | X | | X |
| | >0.85 | 20 | day electrofishing | BWCS | X | X | X | X | | X |
| Channel catfish | >0.60 | 20 | Small hoop nets | MCBU,SCB | | X | | | | |
| | >0.60 | 20 | Small hoop nets, day electrofishing | MCBU,SCB | | | | X | X | X |
| | 0.81 | 50 | Small hoop nets | MCBU | | | X | | | |
| | 0.36 | 50 | Small hoop nets | MCBU | X | | | | | |
| Common carp | 0.90 | 20 | day electrofishing | SCB | X | X | X | X | X | X |
| Emerald shiner | >0.75 | 20 | day electrofishing | MCBU | X | X | X | | | X |
| | 0.65 | 20 | day electrofishing | MCBU | | | | X | | |
| | 0.50 | 20 | day electrofishing | MCBU | | | | | X | |
| Freshwater drum | >0.60 | 20 | day electrofishing | BWCS,SCB | X | X | X | X | X | X |
| Gizzard shad | >0.75 | 20 | day electrofishing | BWCS | X | | X | X | | X |
| | 0.65 | 20 | day electrofishing | BWCS | | X | | | | |
| | >0.95 | 20 | day electrofishing | MCBU, SCB | | | | | X | X |
| Largemouth bass | >0.75 | 20 | day electrofishing | BWCS | X | X | X | | | X |
| | 0.22 | 20 | day electrofishing | BWCS | | | | X | | |
| | 0.99 | 20 | day electrofishing | IMPS | | | | X | | |
| Northern pike | 0.75 | 50 | fyke nets | BWCS | | X | | | | |
| | 0.51 | 50 | tandem fyke nets | BWCO | X | | | | | |
| | 0.40 | 50 | fyke nets | BWCS | | | X | | | |
| Sauger | 0.80 | 50 | day electrofishing | SCB | X | X | | | | X |
| | <0.40 | 50 | day electrofishing | SCB | | | X | X | X | |
| | >0.90 | 20 | night electrofishing[c] | MCBU, SCB | | X | | | | |
| | >0.60 | 20 | night electrofishing[c] | MCBU, SCB | | | X | | | |
| Smallmouth buffalo | 0.60 | 20 | large hoop nets | MCBU | X | | | X | | X |
| | 0.60 | 50 | large hoop nets | MCBU | | X | | | | |
| | 0.80 | 50 | tandem fyke nets | SCB | | | X | | | |
| | 0.70 | 50 | tandem fyke nets | SCB | | | | | X | |
| Walleye | 0.68 | 50 | day electrofishing | SCB | X | | | | | |
| | 0.34 | 50 | day electrofishing | MCBU | | X | | | | |
| | 0.28 | 50 | day electrofishing | MCBU | | | X | | | |
| | >0.90 | 20 | night electrofishing[c] | MCBU,SCB | | X | | | | |
| White bass | >0.60 | 20 | day electrofishing | MCBU | X | X | X | X | X | X |
| White crappie | >0.70 | 20 | fyke nets | BWCS | | | X | | | X |
| | 0.19 | 50 | fyke nets | BWCS | X | | | | | |
| | 0.52 | 50 | fyke nets | BWCS | | X | | | | |
| | 0.74 | 50 | fyke nets | BWCS | | | | X | | |

[a]BWCO = Backwater contiguous lake offshore, BWCS = Backwater contiguous lake shoreline, IMPS = Backwater contiguous impounded shoreline, MCBU = Main channel border unstructured, SCB = Side channel border.
[b]P4 = Navigation Pool 4, P8 = Navigation Pool 8, P13 = Navigation Pool 13, P26 = Navigation Pool 26, OR = Open River; LG = La Grange Pool.
[c]Night electrofishing is presently considered an optional (nonmandatory) method in the LTRMP fish monitoring design.

annual catch and variance by species and gear type for each trend analysis area are presented in Appendix D (for fish of all sizes) and Appendix E (for fish less than 120 mm in total length).

When the LTRMP fish sampling design was developed, a multiple gear-aquatic area category approach, intended to evaluate the fish community within each trend analysis area, was selected rather than a target species approach. Thus, although LTRMP partners expressed special interest in the 14 species listed above, we also evaluated information on all species collected within a trend analysis area. During the years under investigation, the fish monitoring design collected 132 of the 139 species reported from the sampled reaches (Fremling et al. 1989).

Power varied considerably among the species and gears (Table 3, Appendix C). For example, Figure 4 demonstrates the range of power observed at present levels of effort for the 77 species collected in Navigation Pool 13 in the aquatic area category of backwater contiguous shoreline with four different sampling collection methods. Figure 5 shows how power for these species generally increases as mean CPUE increases. Across all species, gears, and aquatic area categories, electrofishing generally produced the greatest power (Table 3, Appendix C). However, for some species and aquatic area categories, fyke nets or hoop nets produced greater power than electrofishing (Table 3, Appendix C).

To evaluate power within a trend analysis area at different levels of effort, we tentatively established a level of 0.70 (to detect a 20% change in mean CPUE of a species from year to year at $\alpha = 0.05$) as a guideline of power adequacy. Results indicated that at present effort levels, this criterion was met for 41 species within at least one trend analysis area. However, our power to detect change in uncommon species (including threatened and endangered species) was limited. For example, the power to detect a 20% change for paddlefish with large hoop nets in the Open River trend analysis area was only 0.20.

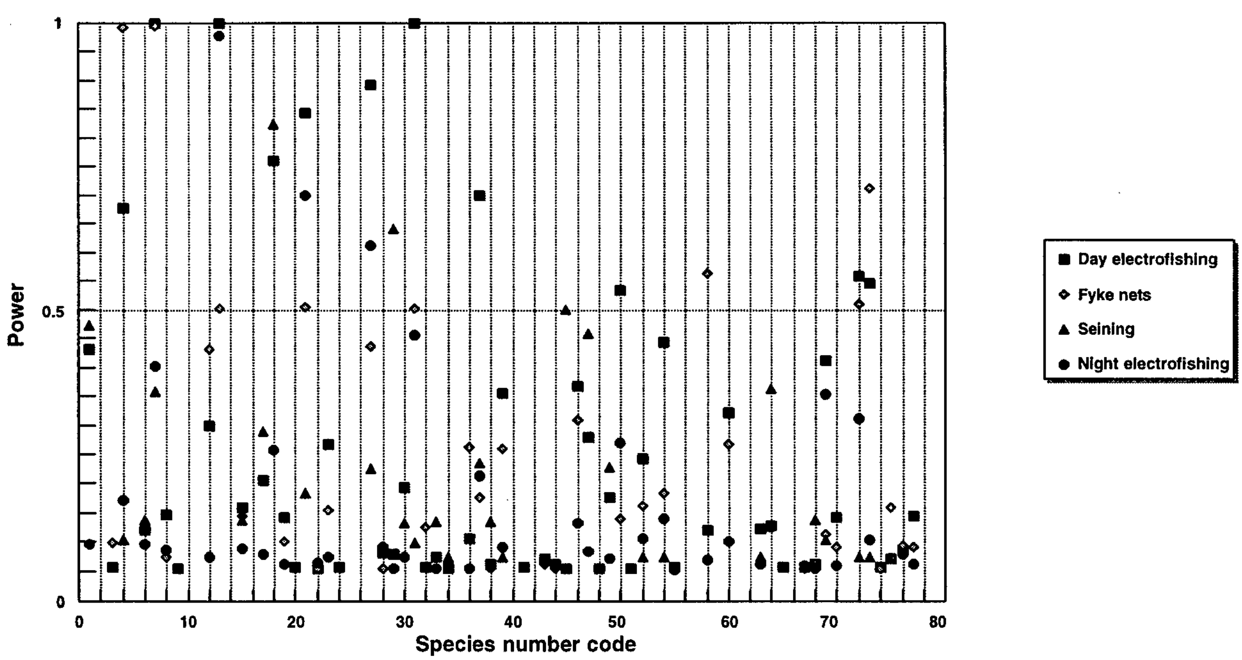



**Figure 4.** Power (at $\alpha = 0.05$) to detect annual change in mean catch-per-unit-effort for fish by gear. In this example, results are presented for the 77 species collected in backwater contiguous lake shoreline aquatic areas in Navigation Pool 13. Gear symbols in each vertical line are for a single species. Wide variations in power were observed across gears for individual species and across all species.

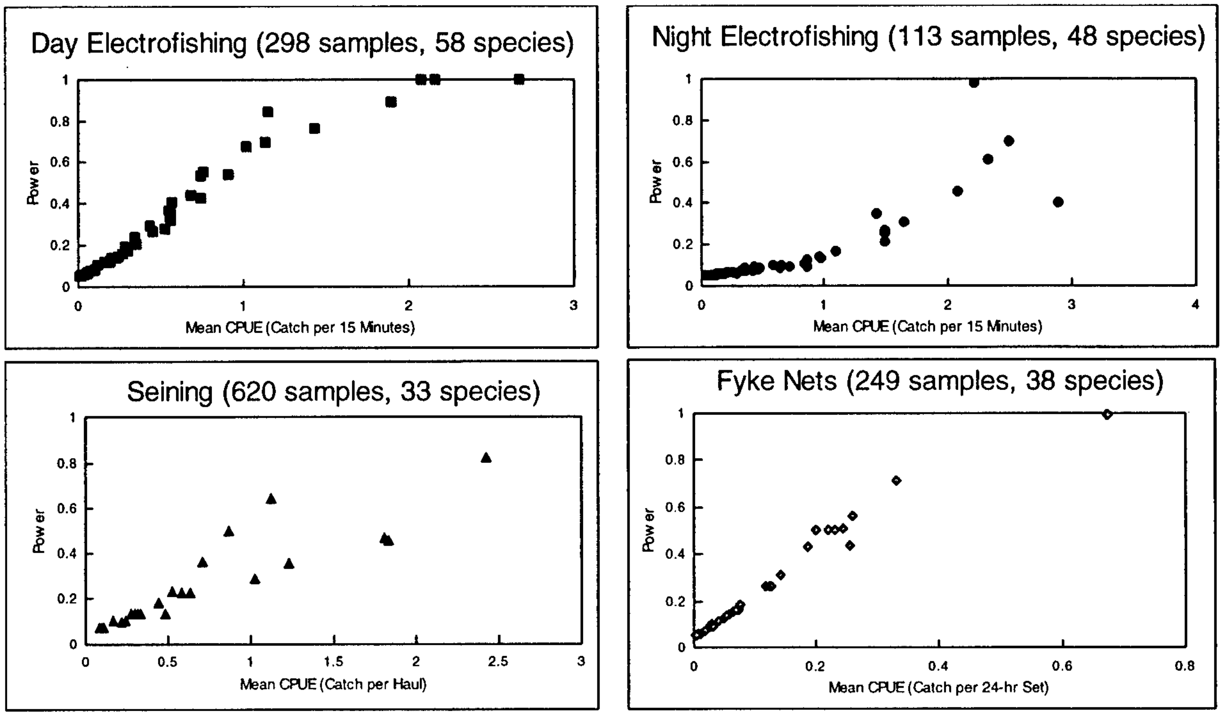



**Figure 5.** Power ($\alpha = 0.05$) to detect annual change in mean catch-per-unit-effort (CPUE) for individual fish species. The CPUE required to reach a selected power differs by gear and sample size. This example shows results for four gears fished in backwater contiguous lake shoreline aquatic areas of Navigation Pool 13.

Halving our fish sampling efforts reduced the number of species for which we could adequately detect annual change to 25. Doubling our sampling effort increased the number of species to 54, although it would not substantially improve our ability to assess changes in the relative abundances of uncommon species.

## Aquatic Vegetation

Observed power ranges for detecting change in the frequency of submersed and rooted floating–leaf vegetation along fixed transects are presented in Table 4. Sample sizes ranged from 18 to 441. At present levels of effort, power to detect a 20% increase or decrease in frequency exceeded 0.50 for most species.

Power was related to sample size and to the frequency of occurrence of each species. Power curves were, therefore, developed to calculate potential power levels for ranges of these factors. Figure 6 presents power curves, at an $\alpha$ of 0.20, associated with detecting a 50% change in the frequency of a plant species at different starting frequency levels and sample sizes.

The curves presented in Figure 6 are also useful for anticipating power associated with varying sample sizes of future stratified random samples. Stratified random sample sizes across aquatic area categories in 1998 ranged from 30 to 210. Based on Figure 6, at a sample size of 30, power would be 0.7 or greater for detecting a 50% change for species with a frequency of occurrence greater than 0.45. At a sample size of 200, the same power would be achieved for species with frequencies of occurrence greater than about 0.07. Because 1998 was the first year of stratified random sampling for aquatic vegetation, no direct observations of change over time were possible.

## Macroinvertebrates

Power to detect a 20% annual change (at $\alpha = 0.20$) in the presence of mayflies and fingernail

Power to detect a 20% annual change (at $\alpha = 0.20$) in the presence of mayflies and fingernail clams, within aquatic area categories and within trend analysis areas (all aquatic area categories combined) are presented in Table 5. Power was consistently greater in Navigation Pools 4, 8, and 13 because of the greater frequencies of occurrence of macroinvertebrates in the nonchannel aquatic area categories of these trend analysis areas.

The lack of nonchannel aquatic area categories in the Open River and their limited presence in Navigation Pool 26 and La Grange Pool required that greater proportions of samples be allocated to main channel border and side channel areas of these three trend analysis areas. Channel areas are characterized by relatively high current velocities, especially at high river discharges, and by coarse sand substrates. These conditions are less suitable for the targeted soft-substrate macroinvertebrates. Low frequencies of occurrence of

**Table 4.** Ranges of power ($\alpha = 0.05$) for detecting a 20% annual change in the frequency of occurrence of aquatic vegetation (any species) along transects at halved, present, and doubled levels of effort in the Long Term Resource Monitoring Program Trend Analysis areas. Vegetation sampling was not conducted in Open River.

| Trend analysis area | Transect | Halved effort | Present effort | Doubled effort |
|---|---|---|---|---|
| Pool 4 | | | | |
| | Big Lake | 0.61 - 0.99 | 0.92 - 0.99 | >0.99 |
| | Rice Lake | 0.37 - 0.99 | 0.57 - 0.99 | 0.88 - 0.99 |
| | Catherine Pass | 0.38 - 0.99 | 0.58 - 0.99 | 0.90 - 0.99 |
| | Dead Slough | 0.54 - 0.99 | 0.86 - 0.99 | >0.99 |
| | Goose Lake | 0.26 - 0.99 | 0.31 - 0.99 | 0.45 - 0.99 |
| | Mud Lake | 0.33 - 0.99 | 0.49 - 0.99 | 0.78 - 0.99 |
| | Lower Peterson | 0.53 - 0.99 | 0.84 - 0.99 | >0.99 |
| | Upper Peterson | 0.44 - 0.99 | 0.70 - 0.99 | 0.97 - >0.99 |
| | Robinson Lake | 0.75 - 0.99 | ≥0.99 | >0.99 |
| Pool 8 | | | | |
| | Blue Lake | 0.54 - 0.99 | 0.86 - 0.99 | >0.99 |
| | Goose Island | 0.49 - 0.99 | 0.79 - 0.99 | ≥0.99 |
| | Horseshoe HREP[a] | 0.43 - 0.99 | 0.63 - 0.99 | 0.94 - 0.99 |
| | Lawrence Lake | ≥0.99 | ≥0.99 | ≥0.99 |
| | Pool 8 Islands | 0.46 - 0.99 | 0.74 - 0.99 | 0.98 - 0.99 |
| | Shady Maple | 0.46 - 0.99 | 0.75 - 0.99 | ≥0.99 |
| | Stoddard | 0.31 - 0.99 | 0.45 - 0.99 | 0.72 - 0.99 |
| | Target Lake | 0.89 - 0.99 | ≥0.99 | ≥0.99 |
| Pool 13 | | | | |
| | Brown's Lake | ≥0.99 | >0.99 | >0.99 |
| | Johnson Creek Levee | 0.48 - 0.99 | 0.78 - 0.99 | ≥0.99 |
| | Lower Johnson Creek | 0.36 - 0.99 | 0.54 - 0.99 | 0.86 - 0.99 |
| | Pomme de Terre | 0.41 - 0.99 | 0.64 - 0.99 | 0.94 - 0.99 |
| | Potter's Marsh | 0.54 - 0.99 | 0.85 - 0.99 | >0.99 |
| | Savanna Bay | 0.57 - 0.99 | 0.89 - 0.99 | >0.99 |
| | Spring Lake | 0.67 - 0.99 | 0.96 - 0.99 | >0.99 |
| Pool 26 | | | | |
| | Calhoun Point | 0.59 - 0.99 | 0.90 - 0.99 | >0.99 |
| | Fuller Lake | 0.65 - 0.99 | 0.95 - 0.99 | >0.99 |
| | Stump Lake | 0.64 - 0.99 | 0.94 - 0.99 | >0.99 |
| | Swan Lake | 0.89 - 0.99 | >0.99 | >0.99 |
| La Grange Pool | | | | |
| | Bulrush Pond | 0.24 - 0.98 | 0.28 - 0.99 | 0.37 - 0.99 |
| | Grape Island | 0.24 - 0.52 | 0.28 - 0.83 | 0.37 - 0.99 |
| | Point Lake | 0.26 - 0.93 | 0.31 - 0.99 | 0.45 - 0.99 |
| | Spring Lake | 0.41 - 0.95 | 0.65 - 0.99 | 0.95 - 0.99 |

[a]HREP = Habitat Rehabilitation and Enhancement Project

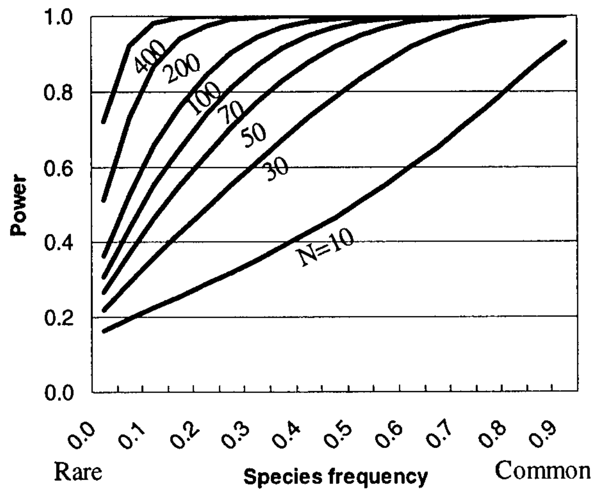



**Figure 6.** Power curves ($\alpha = 0.20$), at several sample sizes, for detecting a 50% annual change in the frequency of occurrence of an aquatic plant species.

macroinvertebrates in these areas reduced our power to detect change. Moreover, estimated levels of power at double the present effort were still low.

## Sampling Frequency for Macroinvertebrates

Figure 7 presents annual monitoring results for mayflies in Navigation Pool 8. Figure 7A includes results from all years and suggests a cycle in mayfly densities. Figure 7B shows the different data sets that would have resulted from sampling at 3-year intervals with different starting years. The 3-year sampling result suggest trends, but the mean abundance estimated over all years would be similar for each data set.

**Table 5.** Power ($\alpha = 0.20$) to detect a 20% change in the presence of mayflies and fingernail clams from 1992 through 1999 at halved, present, and doubled levels of effort in trend analysis areas (*bold face*) and aquatic area categories.

| Trend analysis area | Aquatic area category[a] | Mayflies | | | Fingernail clams | | |
|---|---|---|---|---|---|---|---|
| | | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort |
| **Pool 4** | **All** | **0.39** | **0.54** | **0.75** | **0.31** | **0.41** | **0.57** |
| | BWC | 0.33 | 0.44 | 0.62 | 0.25 | 0.30 | 0.38 |
| | IMP | 0.35 | 0.47 | 0.66 | 0.45 | 0.63 | 0.85 |
| | MCB | 0.20 | 0.21 | 0.21 | 0.20 | 0.20 | 0.21 |
| | SC | 0.20 | 0.21 | 0.22 | 0.20 | 0.20 | 0.21 |
| **Pool 8** | **All** | **0.38** | **0.52** | **0.73** | **0.27** | **0.33** | **0.44** |
| | BWC | 0.27 | 0.34 | 0.45 | 0.22 | 0.25 | 0.29 |
| | IMP | 0.32 | 0.42 | 0.59 | 0.24 | 0.28 | 0.35 |
| | MCB | 0.20 | 0.20 | 0.21 | 0.20 | 0.20 | 0.21 |
| | SC | 0.22 | 0.25 | 0.29 | 0.21 | 0.22 | 0.23 |
| **Pool 13** | **All** | **0.50** | **0.69** | **0.89** | **0.54** | **0.75** | **0.93** |
| | BWC | 0.37 | 0.51 | 0.71 | 0.36 | 0.49 | 0.68 |
| | IMP | 0.36 | 0.49 | 0.68 | 0.48 | 0.67 | 0.88 |
| | MCB | 0.21 | 0.22 | 0.23 | 0.21 | 0.22 | 0.23 |
| | SC | 0.22 | 0.25 | 0.29 | 0.22 | 0.24 | 0.28 |
| **Pool 26** | **All** | **0.23** | **0.26** | **0.33** | **0.21** | **0.22** | **0.24** |
| | BWC | 0.25 | 0.29 | 0.37 | 0.21 | 0.22 | 0.23 |
| | IMP | 0.24 | 0.27 | 0.34 | 0.21 | 0.22 | 0.24 |
| | MCB | 0.20 | 0.21 | 0.21 | 0.20 | 0.20 | 0.20 |
| | SC | 0.20 | 0.21 | 0.22 | 0.20 | 0.20 | 0.20 |
| **Open River** | **All** | **0.24** | **0.27** | **0.34** | **0.20** | **0.21** | **0.22** |
| | MCB | 0.21 | 0.23 | 0.26 | 0.20 | 0.20 | 0.20 |
| | SC | 0.23 | 0.26 | 0.38 | 0.20 | 0.20 | 0.20 |
| **La Grange Pool** | **All** | **0.25** | **0.29** | **0.37** | **0.26** | **0.32** | **0.43** |
| | BWC | 0.22 | 0.24 | 0.28 | 0.22 | 0.24 | 0.28 |
| | MCB | 0.21 | 0.26 | 0.24 | 0.23 | 0.25 | 0.21 |
| | SC | 0.25 | 0.30 | 0.38 | 0.25 | 0.29 | 0.38 |

[a]BWC = Backwater contiguous lake; IMP = Backwater continguous impounded; MCB = Main channel border; SC = side channel.

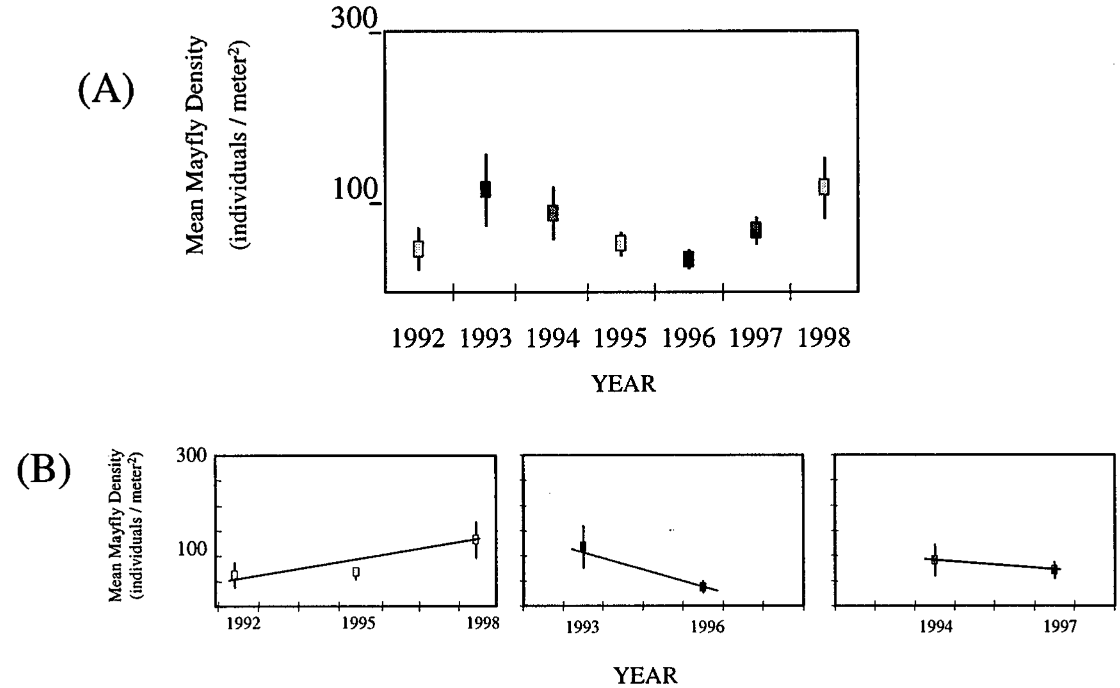



**Figure 7.** Mean densities of mayflies in the Navigation Pool 8 trend analysis area based on (*A*) all 7 sampling years, and (*B*) 3-year sampling intervals. Vertical lines indicate ± 1 standard error.

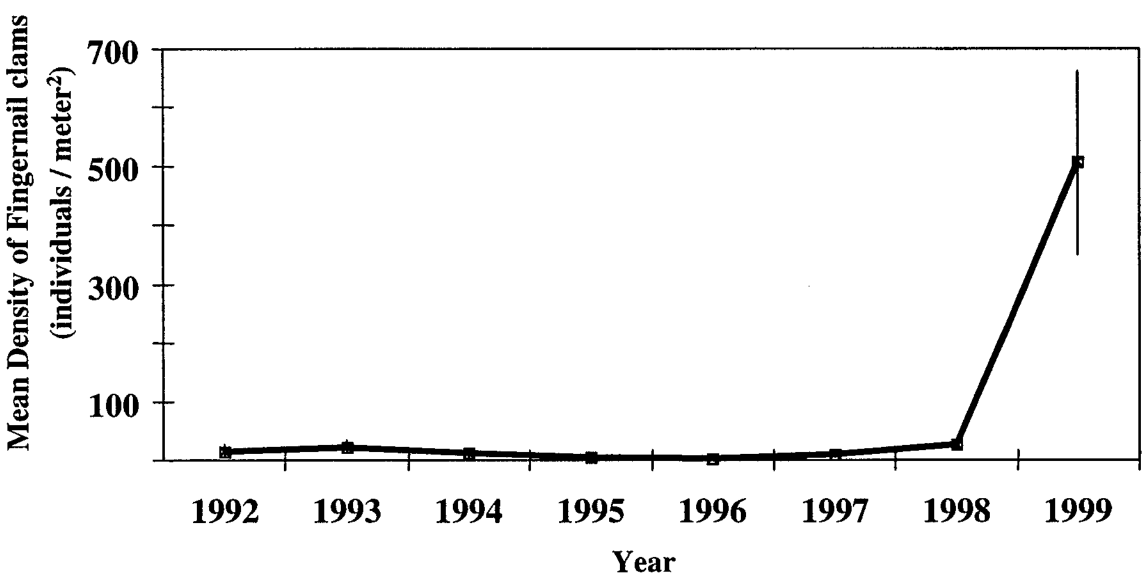



**Figure 8.** Mean densities of fingernail clams in the Navigation Pool 8 trend analysis area 1992–1999. Vertical lines indicate ± 1 standard error.

fingernail clam densities in Navigation Pool 8, densities increased rapidly in 1999 (Figure 8), coinciding with a substantial increase in the use of the area by migratory waterfowl in fall 1999. Rapid changes, such as this, are most effectively documented with a sampling interval of 1 year or less.

### *Question 2: Are there spatial redundancies in the Program?*

Figure 9 provides examples of cluster analyses based upon the four monitoring components. These

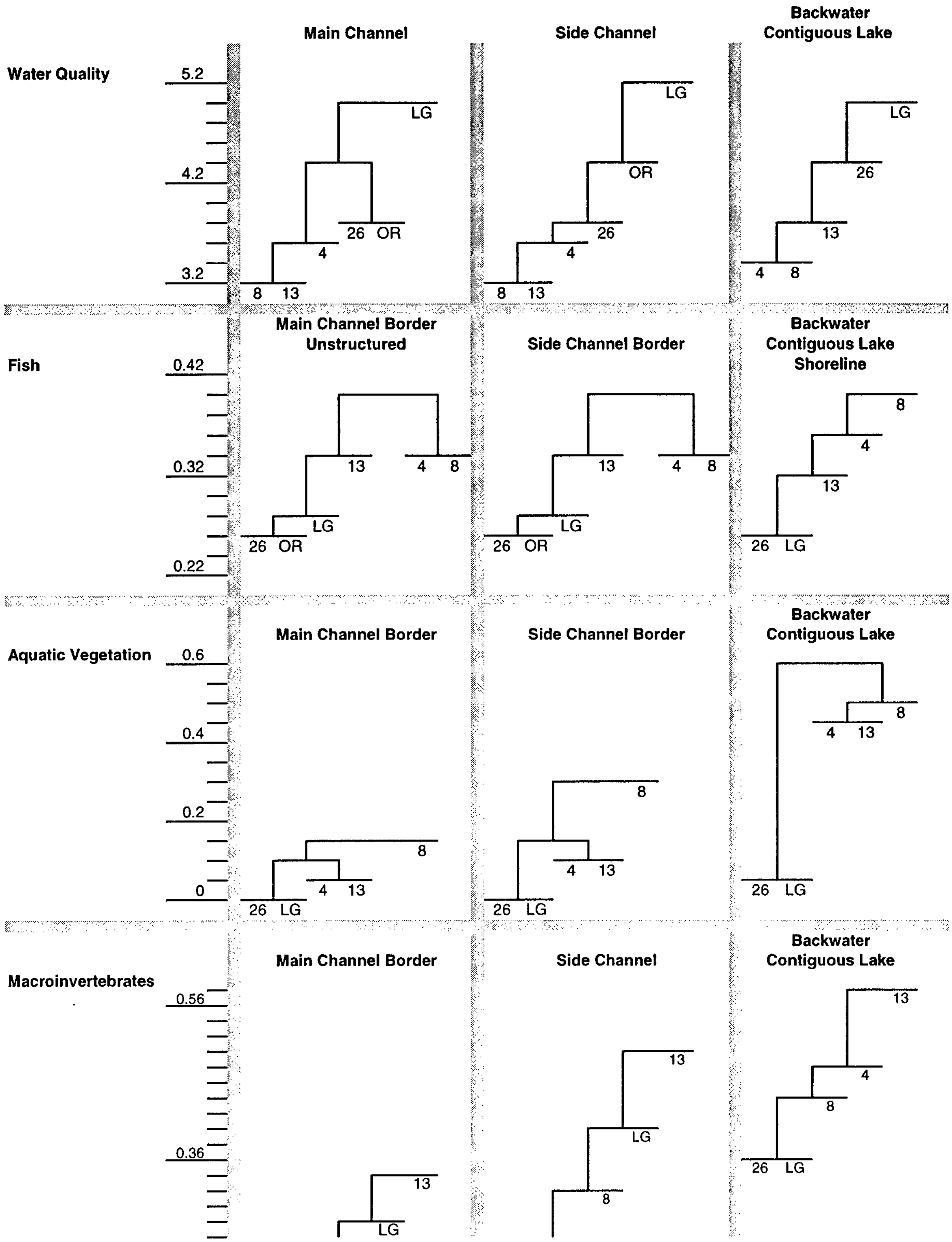



**Figure 9.** Similarities, as expressed by cluster analysis, among the trend analysis areas across components and aquatic area categories. Vertical scale values (Euclidean distances for water quality; correlation coefficients for other components) are only conservatively comparable because of the different sample sizes among aquatic area categories and components. Fish results are based on day electrofishing samples. Aquatic vegetation results are based on floristic and abundance features. Macroinvertebrate results are based on presence/ absence of data.

analyses were selected from many that were available because they reflected general trends seen in the results and because they included five or six trend analysis areas. Many of the other analyses clustered four or fewer trend analysis areas because not all of the trend analysis areas included the same aquatic area categories.

Cluster analyses of numerous physical and biological variables indicated that, for macroinvertebrates, there was no obvious relation among trend analysis areas (Figure 9). However, for all other components, either the upper trend analysis areas (Navigation Pools 4, 8, and 13) or the lower trend analysis areas (Navigation Pool 26, Open River, La Grange Pool) clustered together first, indicating greater similarity within these two groups than between them. For example, analyses based on water quality generally clustered the upper trend analysis areas first, followed by the lower trend analysis areas. Analyses based on fish and aquatic vegetation clustered the lower trend analysis areas first. The only discrepancy noted in this pattern was that the fish component in Navigation Pool 13 was sometimes more similar to the lower trend analysis areas than to Navigation Pools 4 and 8 (e.g., main channel border shoreline and side channel border aquatic areas, Figure 9). Our results agree with similar analyses performed by Callahan (1998).

## Multiyear Patterns from Trend Analysis Areas

A comparison of multiyear patterns in turbidity and aquatic vegetation illustrated that some variables tend to exhibit closely synchronized patterns across trend analysis areas, whereas others appear to be unrelated. Turbidity, for example, which often shows a seasonal pattern because of its dependence on flow, exhibited similar patterns in the three upper trend analysis areas (Figure 10). This similarity reflects the proximity of these trend analysis areas to each other and the dominant influence of main stem hydrologic factors (basin rainfall, soil erosion, sediment loading) to turbidity levels throughout the reach. The lower trend analysis areas showed less similarity, in part, because of downstream tributaries that drain large basins and present a greater potential for different rainfall patterns and sediment loads.

Temporal patterns in the frequency of occurrence of aquatic vegetation along transects, however, suggested that few similarities exist, either among or within the impounded trend analysis areas (Figure 11). Aquatic vegetation response within these areas seems to be at least partly controlled by local conditions at each transect. The only major poolwide response apparent in the data was the vegetation decline in Navigation Pool 26 following the flood of 1993 (Figure 11, Redmond and Nelson 1994).

Aquatic vegetation responses, as illustrated in Figure 11, indicate that species and ecological processes associated with backwater habitats tend to be controlled by local factors as well as reachwide factors. In backwaters that are more isolated from the main channel, local factors are more likely to influence aquatic vegetation abundance than are reachwide factors.

## *Question 3: Are there gear or method redundancies in the Program?*

### Fish

For fish, electrofishing generally produced the highest power among gears in all trend analysis areas (Table 3, Appendix C), although some species were more effectively sampled by other gears (Appendixes C, D, and E). To investigate the potential for gear redundancies in the fish component, we used the results of power analysis to evaluate the effect of eliminating all passive fishing gears on the total number of species for which we could adequately measure annual change at the trend analysis area scale. The same criterion for power adequacy was used (i.e., a power of 0.70 to detect a 20% annual change in mean CPUE at $\alpha = 0.05$). If we eliminated passive gears, the number of species for which we would have adequate power declined from 41 to 37. The four species involved were northern pike, longnose gar, bowfin, and pugnose minnow.

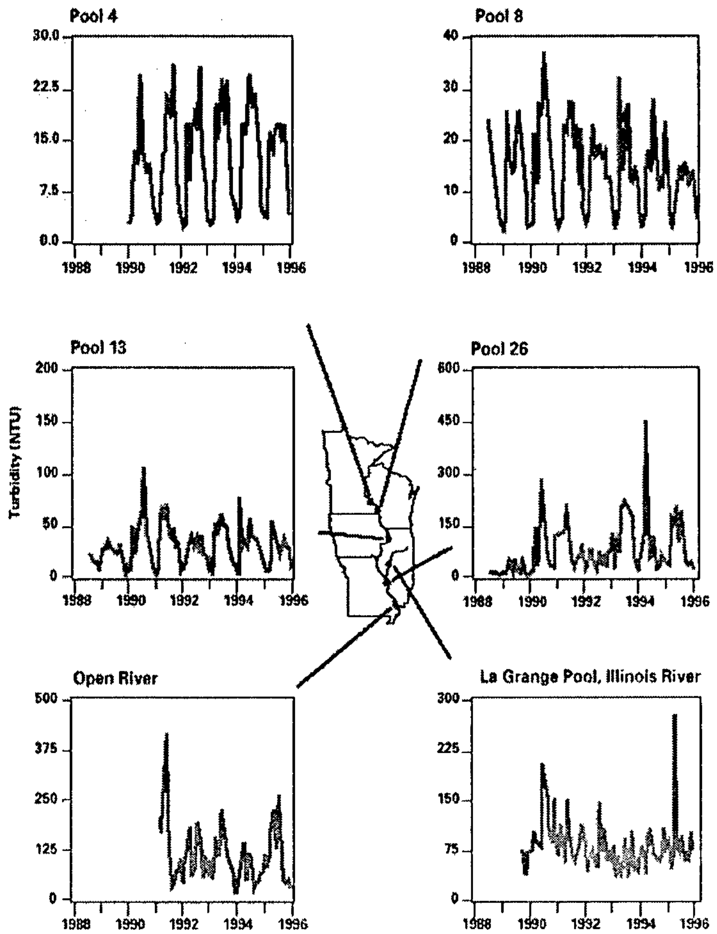



**Figure 10.** Turbidity data from the six trend analysis areas of the Long Term Resource Monitoring Program.

## Aquatic Vegetation

In 1998, we began experimenting with stratified random sampling for aquatic vegetation to provide better poolwide estimates of the distribution and abundance of aquatic vegetation at shallow depths throughout each trend analysis area. Previously, sampling of vegetation was done along transects intended to reflect conditions in specific backwaters or impounded areas, not an entire trend analysis area.

Power curves suggested that both methods were limited for detecting rare species. In an individual backwater, Lawrence Lake (Navigation Pool 8), results from stratified random sampling (n = 19) produced similar estimates for the frequencies of common species and recorded 14 of the 16 species documented by transect sampling (n = 441, Table 6). At the trend analysis area spatial scale, stratified random sampling was as effective as transect sampling at recording species richness.

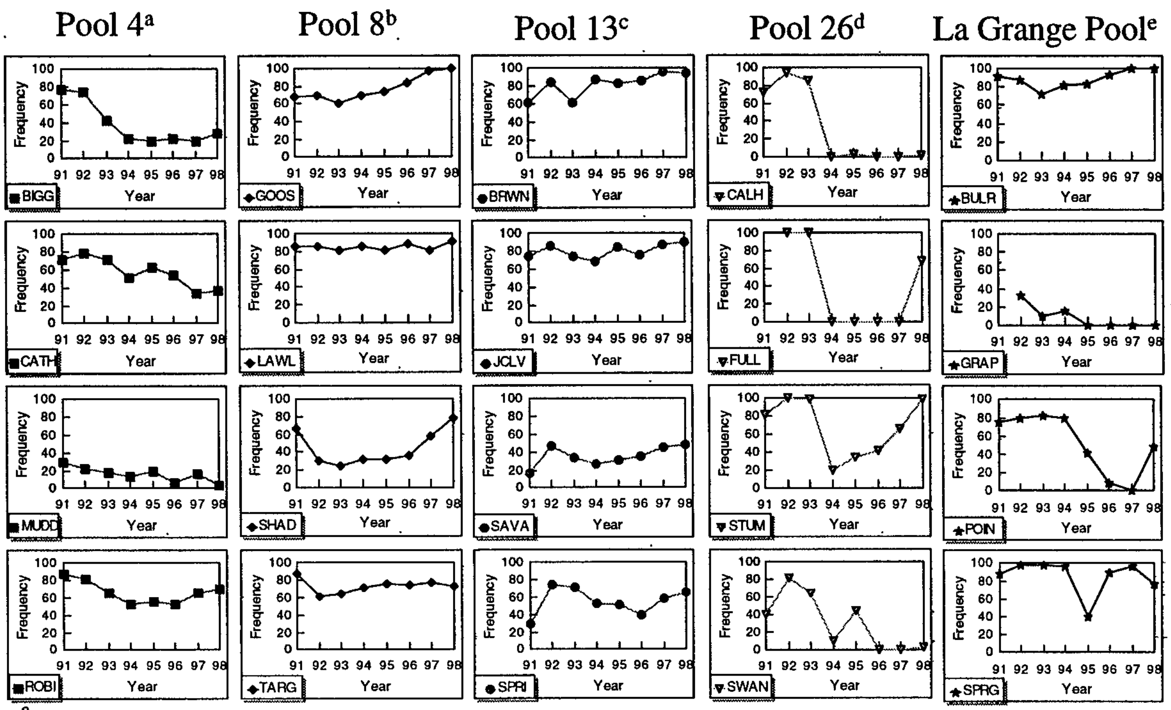
Analyses of several vegetation variables were conducted to explore the consequences of replacing transect sampling with stratified random sampling. The results were expressed for three individual backwaters and for both the aquatic area category and the trend analysis area spatial scales. Replacement of transect sampling would have no negative effects at the two broad spatial scales, but within specific backwaters our ability to detect changes in species richness, species abundance, and community abundance (the frequency of aquatic vegetation regardless of species) would be compromised.

### *Question 4: Are there target variable redundancies in the Program?*

The question of target variable redundancies was directed at the suite of water-quality variables being monitored. Although there were significant correlations among many of the water-quality variables, the correspondence was not close enough (e.g., $R^2 > 0.70$) or consistent enough to consider one variable as a surrogate for another (Table 7). Several of the major cations (Na, Mg, Ca) showed relatively strong correlations with conductivity and among themselves. However, measurements for all three of these variables are produced from a single analysis of each water sample. Thus, elimination of any one of these variables would not reduce effort required for sampling or analysis.

## Discussion

The initial data analyses completed in 1999 provide valuable information for considering future Program modifications. For example, even in the




[a]Locations in Pool 4: BIGG = Big Lake, CATH = Catherine Pass, MUDD = Mud Lake, ROBI = Robinson Lake.
[b]Locations in Pool 8: GOOS = Goose Island, LAWL = Lawrence Lake, SHAD = Shady Maple, TARG = Target Lake.
[c]Locations in Pool 13: BRWN = Brown's Lake, JCLV = Johnson Creek Levee, SAVA = Savanna Bay, SPRI = Spring Lake.
[d]Locations in Pool 26: CALH = Calhoun Point, FULL = Fuller Lake, STUM = Stump Lake, SWAN = Swan Lake.
[e]Locations in La Grange Pool: BULR = Banner Marsh, GRAP = Grape Island, POIN = Point Lake, and SPRG = Spring Lake.

**Figure 11.** Aquatic vegetation response over 8 years at transects in five trend analysis areas. Frequency equals the percentage of sites that were vegetated along each transect. Vegetation response among transects varied substantially within each trend analysis area, with the exception of the uniform decline at all transects in Navigation Pool 26 following the flood of 1993. Transect codes and symbols are included in the lower left corner of each figure.

absence of a rigid power standard, the effort comparisons (halved, present, and doubled) included here are useful for assessing data adequacy under a variety of potential Program modification alternatives. However, we emphasize that the analyses presented in this report represent a first step in the evaluation of Program efficiency. Not completed yet, for instance, are important analyses of the relations among the ecosystem components monitored at the LTRMP.

Power levels for detecting seasonal and biweekly change of water-quality variables are presently adequate, and a doubling of effort would provide little increase in power. Some reduction or redistribution of water-quality effort may be practical and justified.

It is important not to over generalize when considering power levels for water-quality variables in the context of making Program planning decisions. First, reductions in water-quality sampling may affect our ability to make inferences about limiting conditions in small, local habitats within the trend analysis areas. Different combinations of water-quality variables may define the suitability of those habitats.

Second, the ecological significance of a 20% change in a seasonal mean (a common change detection criteria used in this report) varies among the water-quality variables. For example, a decline in soluble-reactive phosphorus from 0.20 to 0.16 mg/L can be produced by small variations in discharge regime or phytoplankton uptake, but the

**Table 6.** Percent frequency of occurrence for aquatic vegetation observed in Lawrence Lake (Navigation Pool 8) in 1998, using transect and stratified random sampling methods. N is sample size.

| Species | Scientic name | Sampling method Transects (n = 441) | Stratified random (n = 19) |
|---|---|---|---|
| Coontail | *Ceratophyllum demersum* | 88 | 95 |
| Canadian waterweed | *Elodea canadensis* | 15 | 37 |
| Eurasion watermilfoil | *Myriophyllum spicatum* | 43 | 42 |
| Nodding waternymph | *Najas flexilis* | 14 | 42 |
| Southern waternymph | *N. guadalupensis* | 0.1 | 0 |
| American lotus | *Nelumbo lutea* | 16 | 21 |
| Narrow-leaf pondweed | *Potamogeton foliosus* or *P. pusillus* | 14 | 68 |
| Yellow pondlily | *Nuphar lutea* | 11 | 21 |
| White waterlily | *Nymphaea odorata* | 52 | 63 |
| Curly pondweed | *Potamogeton crispus* | 22 | 53 |
| Long-leaf pondweed | *P. nodosus* | 1 | 11 |
| Sago pondweed | *P. pectinatus* | 34 | 21 |
| Flatstem pondweed | *P. zosteriformis* | 9 | 47 |
| Common bladderwort | *Utricularia macrorhiza* | 13 | 31 |
| Wild celery | *Vallisneria americana* | 0.5 | 0 |
| Water stargrass | *Heteranthera dubia* | 10 | 11 |

ecological consequences of this change may be nondetectable. However, a change in mean temperature from 20° to 16°C could easily affect the spawning success of a fish species. A shift in average dissolved oxygen from 5 to 4 mg/L could represent a substantial increase in the size of an area that experiences oxygen depletion. Ideally, planning decisions should consider power to detect change in any physical variable relative to its biological significance.

Our ability to detect change for the biological components was clearly related to two factors, sample size and the frequency of collection of different species (or the extent of defined habitats). The fact that the fish monitoring design collected 132 of the 139 species historically reported from the sampled reaches is an indicator of success in addressing large-scale community composition. We were able to detect a 20% change (at $\alpha = 0.05$) in annual mean CPUE for 41 fish species within at least one trend analysis area. Therefore, it seems that the Program's fish

**Table 7.** Correlation matrix of the water-quality variables measured at stratified random sites of the Long Term Resource Monitoring Program.

| Water-quality variables[a] | Temp | DO | Cond | Secchi | Turb | TSS | TN | NOX | TP | SRP |
|---|---|---|---|---|---|---|---|---|---|---|
| **Temp** | 1.00 | -0.53 | -0.11 | -0.47 | 0.16 | 0.22 | -0.02 | -0.18 | 0.21 | 0.00 |
| **DO** | | 1.00 | -0.05 | 0.25 | -0.17 | -0.24 | -0.11 | 0.02 | -0.24 | -0.15 |
| **Cond** | | | 1.00 | -0.07 | 0.03 | 0.01 | 0.41 | 0.45 | 0.20 | 0.40 |
| **Secchi** | | | | 1.00 | -0.27 | -0.45 | -0.15 | -0.03 | -0.26 | -0.04 |
| **Turb** | | | | | 1.00 | 0.74 | 0.10 | 0.04 | 0.29 | 0.02 |
| **TSS** | | | | | | 1.00 | 0.18 | 0.08 | 0.37 | 0.00 |
| **TN** | | | | | | | 1.00 | 0.68 | 0.14 | 0.22 |
| **NOX** | | | | | | | | 1.00 | 0.00 | 0.17 |
| **TP** | | | | | | | | | 1.00 | 0.43 |
| **SRP** | | | | | | | | | | 1.00 |

[a]Temp = temperature; DO = dissolved oxygen; Cond = conductivity; Secchi = Secchi disk transparency; Turb = turbidity; TSS = total suspended solids; TN = total nitrogen; NOX = nitrate/nitrite; TP = total phosphorus; and SRP = soluble-reactive phosphorus.

community approach to sampling also adequately documents changes in many individual species at present levels of effort. A doubling of fish sampling effort would not appreciably enhance power for rare species.

Power results and cluster analyses suggested that some reductions in the fish sampling effort could be implemented with little loss of information. The specific consequences of selected options for reducing effort, such as eliminating passive or apparent duplicative gears, merit further examination.

Power levels associated with historical transect sampling for aquatic vegetation were adequate. In contrast, the low power levels for detecting change in macroinvertebrates, especially in Navigation Pool 26, Open River, and La Grange Pool trend analysis reaches should prompt further analysis and alternative sampling strategies. The comparison of annual and every third-year sampling intervals for mayflies indicated that sampling at less than annual intervals would reduce our ability to rapidly detect short-term change.

Cluster analyses generally indicated greater similarity within the three upper and the three lower trend analysis areas than among them. Biological conditions and responses at several spatial scales will remain of interest within the Program, but fully effective monitoring at each scale is unlikely to be affordable. The change in the aquatic vegetation design from transect to stratified random sampling illustrates a case where both methods provide valuable information, but each is most effective at a different spatial scale. Early results suggest that stratified random vegetation sampling will improve our ability to make poolwide inferences and will maintain the Program's ability to track the frequency of occurrence of most common species at the aquatic area category scale, although there will be fewer observations in individual backwaters.

## Acknowledgments

We thank L. Bartsch, S. Gutreuter, E. Kirsch, T. Koel, C. Theiling, J. Wiener, S. Zigler, and members of the LTRMP Analysis Team for constructive reviews.

## References

Callahan, E. 1998. Similarities between Upper Mississippi River pools included in the Long Term Resource Monitoring Program (LTRMP). Report submitted to the Environmental Management Technical Center, U.S. Geological Survey, Onalaska, Wisconsin. 13 pp. + Appendixes.

Fremling, C. R., J. L. Rasmussen, R. E. Sparks, S. P. Cobb, C. F. Bryan, and T. O. Claflin. 1989. Pages 309–351 *in* D. P. Dodge, editor. Mississippi River fisheries: A case history. Proceedings of the International Large River Symposium. Canadian Special Publication of Fisheries and Aquatic Sciences 106.

Gibbs, J. P., S. Droege, and P. Eagle. 1998. Computers in biology. Monitoring populations of plants and animals. BioScience 48:935–940.

Gutreuter, S., R. Burkhardt, and K. Lubinski. 1995. Long Term Resource Monitoring Program Procedures: Fish monitoring. National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, July 1995. LTRMP 95-P002-1. 42 pp. + Appendixes A–J.

Jackson, G. A., C. E. Korschgen, P. A. Thiel, J. M. Besser, D. W. Steffeck, and M. H. Bockenhauer. 1981. A Long Term Resource Monitoring Plan for the Upper Mississippi River System. Contract Number 14-16-009-81-903. Upper Mississippi River Basin Commission, Bloomington, Minnesota. 2 vols.

Johnson, D. H. 1999. The insignificance of statistical significance testing. Journal of Wildlife Management 63:763–772.

Lubinski, K. 1993. A conceptual model of the Upper Mississippi River System ecosystem. U.S. Fish and Wildlife Service, Environmental Management Technical Center, Onalaska, Wisconsin. EMTC 93-T001. 23 pp.

Peterman, R. M. 1990. Statistical power analysis can improve fisheries research and management. Canadian Journal of Fisheries and Aquatic Sciences 47:2–15.

Rasmussen, J. L. 1979. A compendium of fishery information on the Upper Mississippi River. 2nd edition. Upper Mississippi River Conservation Committee Special Publication. Rock Island, Illinois. 259 pp.

Redmond, A. S., and J. C. Nelson. 1994. Observations on submersed aquatic vegetation in three backwater lakes of the lower Illinois River before and after the 1993 flood. Pages 17–29 *in* National Biological Service, Illinois Natural History Survey, Iowa Department of Natural Resources, and Wisconsin Department of Natural Resources. 1994. Long Term Resource Monitoring Program 1993 flood observations. National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, December 1994. LTRMP 94-S011. 191 pp.

Robins, C. R., C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. 1991. Common and scientific names of fishes from the United States and Canada. 5th edition. Special Publication 20. American Fisheries Society, Bethesda, Maryland. 183 pp.

Soballe, D. M., R. Burkhardt, K. Lubinski, R. Burdis, T. Clemment, J. Fischer, L. Hodge-Richardson, L. Conaway, J. Frazier, D. Gould, M. Steuck, J. Arnold, E. Ratcliff, M. Sitzes, S. Stenzel, and R. Wright. 1995. Long Term Resource Monitoring Program Procedures: Water quality monitoring. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin. (Unpublished report)

Soballe, D. M., and J. T. Rogala. 1996. Estimating the extent of suitable winter habitat in off-channel areas of the Upper Mississippi River system. Annual Meeting, Mississippi River Research Consortium, La Crosse, Wisconsin, April 25–26, 1996.

Thiel, P. A., and J. S. Sauer. 1999. Long Term Resource Monitoring Program Procedures: Macroinvertebrate monitoring. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, Revised May 1999. LTRMP 95-P002-2. (Revised 1999) 7 pp. + Appendixes A–H

Upper Mississippi River Conservation Committee. 1980. A guide to the design, development, and testing of a Monitoring Plan for the Upper Mississippi River System. Upper Mississippi River Conservation Committee, Rock Island, Illinois. 41 pp.

U.S. Fish and Wildlife Service. 1987. Action Plan Report – Environmental Management Program Resource Trend Analysis. St. Paul, Minnesota. 23 pp. + Appendixes A–H.

U.S. Fish and Wildlife Service. 1993. Operating Plan for the Upper Mississippi River System Long Term Resource Monitoring Program. Environmental Management Technical Center, Onalaska, Wisconsin, Revised September 1993. EMTC 91-P002R. 179 pp.

U.S. Geological Survey. 1999. Ecological status and trends of the Upper Mississippi River System 1998: A report of the Long Term Resource Monitoring Program. U.S. Geological Survey, Upper Midwest Environmental Sciences

Center, La Crosse, Wisconsin. April 1999. LTRMP 99-T001. 236 pp.

Venables, W. N., and B. D. Ripley. 1999. Modern applied statistics with S-plus. 3rd edition. Springer Verlag, New York.

Wilcox, D. B. 1993. An aquatic habitat classification system for the Upper Mississippi River System. U.S. Fish and Wildlife Service, Environmental Management Technical Center, Onalaska, Wisconsin. EMTC 93-T003. 9 pp. + Appendix A.

Yin, Y., J. S. Winkelman, and H. A. Langrehr. 2000. Long Term Resource Monitoring Program procedures: Aquatic vegetation monitoring. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, April 2000. LTRMP 95-P002-7. 8 pp. + Appendixes A–C.

# Appendix A. Power Analyses for Water Quality

Appendix A contains 10 tables (A-1 to A-10), one for each water-quality variable, listing statistical power (at $\alpha = 0.20$) to detect a 20% annual change by season, aquatic area category, and trend analysis area at halved, present, and doubled levels of effort.

**Table A-1**. Power (at $\alpha = 0.20$) to detect a 20% change in temperature at halved, present, and doubled levels of effort by aquatic area category (grouped by trend analysis area) and season.

| Trend analysis area | Aquatic area category[a] | Winter | | | Spring | | | Summer | | | Fall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort |
| Pool 4 | BWC | 0.27 | 0.37 | 0.52 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | MC | 0.20 | 0.26 | 0.35 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | 0.22 | 0.28 | 0.39 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| Pool 8 | BWC | 0.22 | 0.30 | 0.41 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | IMP | 0.21 | 0.25 | 0.34 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | MC | 0.24 | 0.37 | 0.53 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | 0.22 | 0.28 | 0.38 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| Pool 13 | BWC | 0.26 | 0.36 | 0.51 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | IMP | 0.56 | 0.78 | 0.95 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | MC | 0.43 | 0.59 | 0.80 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | 0.61 | 0.81 | 0.96 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| Pool 26 | BWC | 0.26 | 0.35 | 0.49 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | IMP | 0.33 | 0.45 | 0.64 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | MC | 0.19 | 0.24 | 0.32 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | 0.24 | 0.33 | 0.46 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| Open River | MC | 0.42 | 0.60 | 0.81 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | 0.38 | 0.53 | 0.74 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| La Grange Pool | BWC | 0.59 | 0.80 | 0.96 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | MC | 0.27 | 0.36 | 0.51 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | 0.40 | 0.57 | 0.78 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |

[a]BWC = backwater contiguous lake, IMP = backwater contiguous impounded, MC = main channel, SC = side channel.

**Table A-2.** Power (at $\alpha = 0.20$) to detect a 20% change in dissolved oxygen at halved, present, and doubled levels of effort by aquatic area category (grouped by trend analysis area) and season.

| Trend analysis area | Aquatic area category[a] | Winter | | | Spring | | | Summer | | | Fall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort |
| Pool 4 | BWC | 0.69 | 0.89 | 0.99 | >0.99 | >0.99 | >0.99 | 0.89 | 0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | MC | 0.38 | 0.53 | 0.74 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| Pool 8 | BWC | 0.33 | 0.47 | 0.66 | >0.99 | >0.99 | >0.99 | 0.58 | 0.80 | 0.96 | 0.93 | >0.99 | >0.99 |
| | IMP | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | MC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| Pool 13 | BWC | 0.37 | 0.53 | 0.73 | >0.99 | >0.99 | >0.99 | 0.78 | 0.95 | >0.99 | >0.99 | >0.99 | >0.99 |
| | IMP | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | 0.97 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | MC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| Pool 26 | BWC | 0.66 | 0.86 | 0.98 | 0.77 | 0.94 | >0.99 | 0.49 | 0.69 | 0.89 | 0.62 | 0.84 | 0.97 |
| | IMP | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | 0.44 | 0.61 | 0.82 | 0.78 | 0.94 | >0.99 |
| | MC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | 0.93 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| Open River | MC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | 0.94 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| La Grange Pool | BWC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | 0.96 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | MC | 0.72 | 0.91 | 0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | 0.75 | 0.93 | >0.99 | >0.99 | >0.99 | >0.99 |

[a]BWC = backwater contiguous lake, IMP = backwater contiguous impounded, MC = main channel, SC = side channel.

**Table A-3.** Power (at $\alpha = 0.20$) to detect a 20% change in conductivity at halved, present, and doubled levels of effort by aquatic area category (grouped by trend analysis area) and season.

| Trend analysis area | Aquatic area category[a] | Winter | | | Spring | | | Summer | | | Fall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort |
| Pool 4 | BWC | 0.98 | >0.99 | >0.99 | 0.75 | 0.93 | >0.99 | 0.94 | >0.99 | >0.99 | 0.86 | 0.98 | >0.99 |
| | MC | 0.99 | >0.99 | >0.99 | 0.53 | 0.75 | 0.93 | 0.90 | 0.99 | >0.99 | 0.71 | 0.91 | 0.99 |
| | SC | >0.99 | >0.99 | >0.99 | 0.81 | 0.96 | >0.99 | 0.87 | 0.98 | >0.99 | 0.76 | 0.93 | >0.99 |
| Pool 8 | BWC | 0.97 | >0.99 | >0.99 | 0.97 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | IMP | >0.99 | >0.99 | >0.99 | 0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | MC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | >0.99 | >0.99 | >0.99 | 0.97 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | 0.97 | >0.99 | >0.99 |
| Pool 13 | BWC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | IMP | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | MC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| Pool 26 | BWC | 0.86 | 0.98 | >0.99 | 0.93 | 0.99 | >0.99 | >0.99 | >0.99 | >0.99 | 0.98 | >0.99 | >0.99 |
| | IMP | 0.95 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | MC | 0.73 | 0.91 | 0.99 | 0.98 | >0.99 | >0.99 | 0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | 0.76 | 0.94 | >0.99 | 0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| Open River | MC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| La Grange Pool | BWC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | MC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |
| | SC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 |

[a]BWC = backwater contiguous lake, IMP = backwater contiguous impounded, MC = main channel, SC = side channel.

**Table A-4.** Power (at $\alpha = 0.20$) to detect a 20% change in Secchi disk transparency at halved, present, and doubled levels of effort by aquatic area category (grouped by trend analysis area) and season.

| Trend analysis area | Aquatic area category[a] | Winter | | | Spring | | | Summer | | | Fall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort |
| Pool 4 | BWC | 0.70 | 0.90 | 0.99 | 0.99 | >0.99 | >0.99 | 0.90 | 0.99 | >0.99 | 0.74 | 0.93 | >0.99 |
| | MC | 0.65 | 0.86 | 0.98 | 0.69 | 0.90 | 0.99 | 0.34 | 0.49 | 0.69 | 0.50 | 0.70 | 0.90 |
| | SC | 0.40 | 0.56 | 0.77 | 0.86 | 0.98 | >0.99 | 0.42 | 0.61 | 0.82 | 0.57 | 0.78 | 0.95 |
| Pool 8 | BWC | 0.53 | 0.74 | 0.92 | 0.99 | >0.99 | >0.99 | 0.84 | 0.97 | >0.99 | 0.88 | 0.99 | >0.99 |
| | IMP | 0.66 | 0.86 | 0.98 | >0.99 | >0.99 | >0.99 | 0.85 | 0.98 | >0.99 | 0.96 | >0.99 | >0.99 |
| | MC | 0.71 | 0.90 | 0.99 | >0.99 | >0.99 | >0.99 | 0.93 | >0.99 | >0.99 | 0.98 | >0.99 | >0.99 |
| | SC | 0.51 | 0.71 | 0.91 | >0.99 | >0.99 | >0.99 | 0.89 | 0.99 | >0.99 | 0.92 | 0.99 | >0.99 |
| Pool 13 | BWC | 0.60 | 0.80 | 0.96 | 0.98 | >0.99 | >0.99 | 0.89 | 0.99 | >0.99 | 0.92 | 0.99 | >0.99 |
| | IMP | 0.42 | 0.59 | 0.81 | 0.91 | 0.99 | >0.99 | 0.65 | 0.86 | 0.98 | 0.71 | 0.91 | 0.99 |
| | MC | 0.73 | 0.92 | 0.99 | 0.89 | 0.99 | >0.99 | 0.98 | >0.99 | >0.99 | 0.98 | >0.99 | >0.99 |
| | SC | 0.44 | 0.61 | 0.82 | 0.98 | >0.99 | >0.99 | 0.99 | >0.99 | >0.99 | 0.97 | >0.99 | >0.99 |
| Pool 26 | BWC | 0.51 | 0.70 | 0.90 | 0.44 | 0.62 | 0.83 | 0.59 | 0.79 | 0.95 | 0.60 | 0.82 | 0.96 |
| | IMP | 0.41 | 0.58 | 0.79 | 0.68 | 0.89 | 0.99 | 0.69 | 0.89 | 0.99 | 0.97 | >0.99 | >0.99 |
| | MC | 0.29 | 0.39 | 0.56 | 0.43 | 0.62 | 0.83 | 0.67 | 0.87 | 0.98 | 0.83 | 0.97 | >0.99 |
| | SC | 0.48 | 0.68 | 0.88 | 0.78 | 0.95 | >0.99 | 0.97 | >0.99 | >0.99 | 0.97 | >0.99 | >0.99 |
| Open River | MC | 0.95 | >0.99 | >0.99 | 0.97 | >0.99 | >0.99 | 0.71 | 0.90 | 0.99 | >0.99 | >0.99 | >0.99 |
| | SC | 0.66 | 0.87 | 0.98 | 0.96 | >0.99 | >0.99 | 0.68 | 0.88 | 0.99 | 0.88 | 0.98 | >0.99 |
| La Grange Pool | BWC | 0.97 | >0.99 | >0.99 | 0.99 | >0.99 | >0.99 | 0.83 | 0.97 | >0.99 | 0.98 | >0.99 | >0.99 |
| | MC | 0.73 | 0.92 | 0.99 | 0.73 | 0.91 | 0.99 | 0.47 | 0.66 | 0.87 | 0.94 | >0.99 | >0.99 |
| | SC | 0.90 | 0.99 | >0.99 | 0.95 | >0.99 | >0.99 | 0.64 | 0.85 | 0.98 | 0.84 | 0.98 | >0.99 |

[a]BWC = backwater contiguous lake, IMP = backwater contiguous impounded, MC = main channel, SC = side channel.

**Table A-5.** Power (at $\alpha = 0.20$) to detect a 20% change in turbidity at halved, present, and doubled levels of effort by aquatic area category (grouped by trend analysis area) and season.

| Trend analysis area | Aquatic area category[a] | Winter | | | Spring | | | Summer | | | Fall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort |
| Pool 4 | BWC | 0.48 | 0.68 | 0.88 | 0.60 | 0.81 | 0.96 | 0.49 | 0.69 | 0.89 | 0.38 | 0.55 | 0.76 |
| | MC | 0.65 | 0.86 | 0.98 | 0.44 | 0.64 | 0.85 | 0.27 | 0.37 | 0.52 | 0.37 | 0.53 | 0.74 |
| | SC | 0.55 | 0.75 | 0.93 | 0.48 | 0.68 | 0.89 | 0.32 | 0.44 | 0.63 | 0.45 | 0.64 | 0.85 |
| Pool 8 | BWC | 0.32 | 0.46 | 0.65 | 0.77 | 0.94 | >0.99 | 0.47 | 0.66 | 0.87 | 0.52 | 0.73 | 0.92 |
| | IMP | 0.65 | 0.85 | 0.98 | 0.83 | 0.97 | >0.99 | 0.62 | 0.83 | 0.97 | 0.69 | 0.90 | 0.99 |
| | MC | 0.57 | 0.78 | 0.95 | 0.78 | 0.94 | >0.99 | 0.93 | >0.99 | >0.99 | 0.81 | 0.96 | >0.99 |
| | SC | 0.48 | 0.67 | 0.87 | 0.82 | 0.97 | >0.99 | 0.77 | 0.94 | >0.99 | 0.76 | 0.94 | >0.99 |
| Pool 13 | BWC | 0.49 | 0.68 | 0.89 | 0.72 | 0.91 | 0.99 | 0.57 | 0.78 | 0.95 | 0.75 | 0.93 | >0.99 |
| | IMP | 0.61 | 0.82 | 0.97 | 0.59 | 0.81 | 0.96 | 0.43 | 0.62 | 0.83 | 0.59 | 0.80 | 0.96 |
| | MC | 0.84 | 0.97 | >0.99 | 0.84 | 0.97 | >0.99 | 0.83 | 0.97 | >0.99 | 0.90 | 0.99 | >0.99 |
| | SC | 0.52 | 0.73 | 0.92 | 0.94 | >0.99 | >0.99 | 0.94 | >0.99 | >0.99 | 0.65 | 0.86 | 0.98 |
| Pool 26 | BWC | 0.28 | 0.39 | 0.56 | 0.24 | 0.33 | 0.46 | 0.35 | 0.48 | 0.68 | 0.38 | 0.54 | 0.75 |
| | IMP | 0.26 | 0.37 | 0.52 | 0.30 | 0.41 | 0.58 | 0.39 | 0.55 | 0.77 | 0.59 | 0.78 | 0.95 |
| | MC | 0.24 | 0.31 | 0.43 | 0.34 | 0.48 | 0.68 | 0.46 | 0.64 | 0.85 | 0.51 | 0.72 | 0.91 |
| | SC | 0.28 | 0.39 | 0.55 | 0.54 | 0.75 | 0.93 | 0.61 | 0.83 | 0.97 | 0.68 | 0.88 | 0.99 |
| Open River | MC | 0.80 | 0.96 | >0.99 | 0.76 | 0.94 | >0.99 | 0.58 | 0.79 | 0.95 | >0.99 | >0.99 | >0.99 |
| | SC | 0.50 | 0.70 | 0.90 | 0.78 | 0.95 | >0.99 | 0.32 | 0.44 | 0.63 | 0.63 | 0.83 | 0.97 |
| La Grange Pool | BWC | 0.69 | 0.89 | 0.99 | 0.89 | 0.99 | >0.99 | 0.68 | 0.88 | 0.99 | 0.78 | 0.95 | >0.99 |
| | MC | 0.50 | 0.70 | 0.90 | 0.55 | 0.76 | 0.94 | 0.35 | 0.49 | 0.69 | 0.76 | 0.93 | >0.99 |
| | SC | 0.66 | 0.87 | 0.98 | 0.61 | 0.82 | 0.96 | 0.35 | 0.48 | 0.68 | 0.56 | 0.78 | 0.95 |

[a]BWC = backwater contiguous lake, IMP = backwater contiguous impounded, MC = main channel, SC = side channel.

**Table A-6.** Power (at $\alpha = 0.20$) to detect a 20% change in total suspended solids at halved, present, and doubled levels of effort by aquatic area category (grouped by trend analysis area) and season.

| Trend analysis area | Aquatic area category[a] | Winter | | | Spring | | | Summer | | | Fall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort |
| Pool 4 | BWC | 0.32 | 0.44 | 0.63 | 0.39 | 0.55 | 0.76 | 0.38 | 0.54 | 0.75 | 0.29 | 0.40 | 0.56 |
| | MC | 0.73 | 0.91 | 0.99 | 0.29 | 0.39 | 0.56 | 0.22 | 0.29 | 0.40 | 0.24 | 0.33 | 0.47 |
| | SC | 0.43 | 0.61 | 0.82 | 0.37 | 0.52 | 0.73 | 0.27 | 0.36 | 0.51 | 0.29 | 0.39 | 0.55 |
| Pool 8 | BWC | 0.27 | 0.37 | 0.53 | 0.65 | 0.85 | 0.98 | 0.46 | 0.64 | 0.85 | 0.36 | 0.52 | 0.72 |
| | IMP | 0.54 | 0.74 | 0.93 | 0.42 | 0.59 | 0.80 | 0.50 | 0.69 | 0.89 | 0.38 | 0.53 | 0.74 |
| | MC | 0.29 | 0.40 | 0.57 | 0.40 | 0.56 | 0.77 | 0.81 | 0.96 | >0.99 | 0.71 | 0.91 | 0.99 |
| | SC | 0.34 | 0.47 | 0.67 | 0.48 | 0.69 | 0.89 | 0.56 | 0.77 | 0.94 | 0.56 | 0.78 | 0.95 |
| Pool 13 | BWC | 0.36 | 0.50 | 0.70 | 0.50 | 0.70 | 0.90 | 0.42 | 0.59 | 0.81 | 0.67 | 0.87 | 0.98 |
| | IMP | 0.30 | 0.42 | 0.60 | 0.41 | 0.58 | 0.79 | 0.32 | 0.45 | 0.64 | 0.40 | 0.56 | 0.78 |
| | MC | 0.33 | 0.46 | 0.65 | 0.64 | 0.85 | 0.98 | 0.60 | 0.81 | 0.96 | 0.76 | 0.93 | >0.99 |
| | SC | 0.35 | 0.49 | 0.69 | 0.69 | 0.89 | 0.99 | 0.71 | 0.91 | 0.99 | 0.86 | 0.98 | >0.99 |
| Pool 26 | BWC | 0.28 | 0.40 | 0.56 | 0.26 | 0.35 | 0.49 | 0.32 | 0.45 | 0.63 | 0.29 | 0.40 | 0.57 |
| | IMP | 0.24 | 0.33 | 0.47 | 0.26 | 0.35 | 0.49 | 0.30 | 0.42 | 0.59 | 0.38 | 0.52 | 0.72 |
| | MC | 0.21 | 0.26 | 0.35 | 0.32 | 0.46 | 0.65 | 0.37 | 0.54 | 0.75 | 0.30 | 0.43 | 0.61 |
| | SC | 0.27 | 0.36 | 0.51 | 0.49 | 0.69 | 0.89 | 0.50 | 0.71 | 0.90 | 0.46 | 0.66 | 0.87 |
| Open River | MC | 0.85 | 0.98 | >0.99 | 0.75 | 0.93 | >0.99 | 0.54 | 0.75 | 0.93 | 0.89 | 0.99 | >0.99 |
| | SC | 0.39 | 0.56 | 0.77 | 0.81 | 0.96 | >0.99 | 0.35 | 0.49 | 0.69 | 0.50 | 0.70 | 0.90 |
| La Grange Pool | BWC | 0.43 | 0.61 | 0.82 | 0.62 | 0.83 | 0.97 | 0.42 | 0.60 | 0.81 | 0.32 | 0.45 | 0.63 |
| | MC | 0.39 | 0.55 | 0.76 | 0.48 | 0.68 | 0.88 | 0.27 | 0.37 | 0.52 | 0.48 | 0.66 | 0.87 |
| | SC | 0.35 | 0.49 | 0.69 | 0.42 | 0.60 | 0.82 | 0.23 | 0.29 | 0.41 | 0.34 | 0.47 | 0.67 |

[a]BWC = backwater contiguous lake, IMP = backwater contiguous impounded, MC = main channel, SC = side channel.

**Table A-7.** Power (at $\alpha = 0.20$) to detect a 20% change in total phosphorus at halved, present, and doubled levels of effort by aquatic area category (grouped by trend analysis area) and season.

| Trend analysis area | Aquatic area category[a] | Winter | | | Spring | | | Summer | | | Fall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort |
| Pool 4 | BWC | 0.44 | 0.62 | 0.84 | 0.71 | 0.89 | 0.99 | 0.69 | 0.90 | 0.99 | 0.55 | 0.75 | 0.93 |
| | MC | 0.74 | 0.93 | >0.99 | 0.39 | 0.57 | 0.78 | 0.68 | 0.89 | 0.99 | 0.53 | 0.75 | 0.93 |
| | SC | 0.74 | 0.93 | >0.99 | 0.61 | 0.81 | 0.96 | 0.62 | 0.82 | 0.96 | 0.63 | 0.86 | 0.98 |
| Pool 8 | BWC | 0.30 | 0.42 | 0.59 | 0.71 | 0.91 | 0.99 | 0.39 | 0.56 | 0.77 | 0.37 | 0.52 | 0.72 |
| | IMP | 0.72 | 0.92 | 0.99 | 0.63 | 0.82 | 0.96 | 0.92 | 0.99 | >0.99 | 0.31 | 0.41 | 0.58 |
| | MC | 0.71 | 0.91 | 0.99 | 0.73 | 0.91 | 0.99 | 0.61 | 0.82 | 0.97 | 0.38 | 0.53 | 0.74 |
| | SC | 0.74 | 0.93 | >0.99 | 0.70 | 0.91 | 0.99 | 0.54 | 0.75 | 0.93 | 0.38 | 0.54 | 0.75 |
| Pool 13 | BWC | 0.36 | 0.51 | 0.71 | 0.64 | 0.84 | 0.97 | 0.35 | 0.49 | 0.69 | 0.63 | 0.84 | 0.98 |
| | IMP | 0.40 | 0.56 | 0.77 | 0.52 | 0.71 | 0.91 | 0.28 | 0.38 | 0.54 | 0.36 | 0.52 | 0.73 |
| | MC | 0.62 | 0.83 | 0.97 | 0.49 | 0.68 | 0.88 | 0.25 | 0.34 | 0.48 | 0.84 | 0.98 | >0.99 |
| | SC | 0.40 | 0.57 | 0.78 | 0.50 | 0.70 | 0.90 | 0.23 | 0.31 | 0.43 | 0.72 | 0.91 | 0.99 |
| Pool 26 | BWC | 0.21 | 0.27 | 0.37 | 0.32 | 0.45 | 0.64 | 0.26 | 0.36 | 0.51 | 0.28 | 0.39 | 0.56 |
| | IMP | 0.30 | 0.43 | 0.61 | 0.34 | 0.48 | 0.68 | 0.20 | 0.27 | 0.37 | 0.30 | 0.43 | 0.61 |
| | MC | 0.34 | 0.49 | 0.69 | 0.49 | 0.67 | 0.87 | 0.25 | 0.34 | 0.47 | 0.47 | 0.69 | 0.89 |
| | SC | 0.36 | 0.51 | 0.71 | 0.76 | 0.94 | >0.99 | 0.38 | 0.55 | 0.76 | 0.75 | 0.92 | >0.99 |
| Open River | MC | 0.93 | 0.99 | >0.99 | 0.64 | 0.85 | 0.98 | 0.37 | 0.52 | 0.73 | 0.66 | 0.86 | 0.98 |
| | SC | 0.84 | 0.97 | >0.99 | 0.51 | 0.72 | 0.91 | 0.30 | 0.42 | 0.60 | 0.43 | 0.62 | 0.83 |
| La Grange Pool | BWC | 0.42 | 0.59 | 0.80 | 0.67 | 0.87 | 0.98 | 0.49 | 0.69 | 0.89 | 0.41 | 0.59 | 0.81 |
| | MC | 0.86 | 0.97 | >0.99 | 0.70 | 0.89 | 0.99 | 0.51 | 0.70 | 0.90 | 0.75 | 0.93 | >0.99 |
| | SC | 0.47 | 0.67 | 0.88 | 0.60 | 0.78 | 0.95 | 0.41 | 0.56 | 0.77 | 0.67 | 0.87 | 0.98 |

[a]BWC = backwater contiguous lake, IMP = backwater contiguous impounded, MC = main channel, SC = side channel.

**Table A-8.** Power (at $\alpha = 0.20$) to detect a 20% change in soluble-reactive phosphorus at halved, present, and doubled levels of effort by aquatic area category (grouped by trend analysis area) and season.

| Trend analysis area | Aquatic area category[a] | Winter | | | Spring | | | Summer | | | Fall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort |
| Pool 4 | BWC | 0.23 | 0.31 | 0.43 | 0.70 | 0.89 | 0.99 | 0.20 | 0.26 | 0.35 | 0.17 | 0.21 | 0.27 |
| | MC | 0.29 | 0.38 | 0.54 | 0.34 | 0.46 | 0.66 | 0.21 | 0.27 | 0.36 | 0.23 | 0.30 | 0.41 |
| | SC | 0.31 | 0.43 | 0.61 | 0.33 | 0.45 | 0.64 | 0.23 | 0.30 | 0.41 | 0.28 | 0.41 | 0.58 |
| Pool 8 | BWC | 0.24 | 0.33 | 0.46 | 0.37 | 0.53 | 0.74 | 0.21 | 0.27 | 0.37 | 0.19 | 0.25 | 0.33 |
| | IMP | 0.37 | 0.55 | 0.76 | 0.34 | 0.47 | 0.67 | 0.27 | 0.36 | 0.52 | 0.47 | 0.68 | 0.88 |
| | MC | 0.28 | 0.39 | 0.55 | 0.19 | 0.25 | 0.33 | 0.20 | 0.27 | 0.36 | 0.73 | 0.91 | 0.99 |
| | SC | 0.35 | 0.48 | 0.68 | 0.36 | 0.49 | 0.69 | 0.21 | 0.27 | 0.37 | 0.64 | 0.88 | 0.99 |
| Pool 13 | BWC | 0.22 | 0.30 | 0.41 | 0.65 | 0.86 | 0.98 | 0.38 | 0.53 | 0.74 | 0.22 | 0.28 | 0.38 |
| | IMP | 0.35 | 0.48 | 0.67 | 0.33 | 0.48 | 0.67 | 0.20 | 0.26 | 0.35 | 0.32 | 0.46 | 0.65 |
| | MC | 0.58 | 0.79 | 0.95 | 0.44 | 0.63 | 0.84 | 0.26 | 0.35 | 0.50 | 0.27 | 0.38 | 0.54 |
| | SC | 0.24 | 0.32 | 0.45 | 0.41 | 0.59 | 0.81 | 0.29 | 0.40 | 0.56 | 0.25 | 0.35 | 0.49 |
| Pool 26 | BWC | 0.16 | 0.19 | 0.24 | 0.21 | 0.27 | 0.36 | 0.17 | 0.22 | 0.28 | 0.14 | 0.15 | 0.18 |
| | IMP | 0.16 | 0.20 | 0.25 | 0.20 | 0.24 | 0.32 | 0.14 | 0.15 | 0.18 | 0.18 | 0.20 | 0.26 |
| | MC | 0.22 | 0.29 | 0.40 | 0.23 | 0.29 | 0.40 | 0.20 | 0.25 | 0.33 | 0.20 | 0.25 | 0.34 |
| | SC | 0.20 | 0.25 | 0.34 | 0.22 | 0.29 | 0.40 | 0.26 | 0.35 | 0.49 | 0.17 | 0.20 | 0.26 |
| Open River | MC | 0.59 | 0.81 | 0.96 | 0.49 | 0.69 | 0.89 | 0.33 | 0.46 | 0.65 | 0.45 | 0.65 | 0.86 |
| | SC | 0.44 | 0.63 | 0.84 | 0.45 | 0.63 | 0.85 | 0.27 | 0.36 | 0.51 | 0.21 | 0.27 | 0.37 |
| La Grange Pool | BWC | 0.22 | 0.28 | 0.39 | 0.38 | 0.54 | 0.75 | 0.28 | 0.38 | 0.54 | 0.19 | 0.23 | 0.31 |
| | MC | 0.54 | 0.73 | 0.92 | 0.39 | 0.54 | 0.74 | 0.61 | 0.83 | 0.97 | 0.51 | 0.67 | 0.88 |
| | SC | 0.39 | 0.56 | 0.78 | 0.28 | 0.39 | 0.55 | 0.25 | 0.34 | 0.48 | 0.18 | 0.24 | 0.32 |

[a]BWC = backwater contiguous lake, IMP = backwater contiguous impounded, MC = main channel, SC = side channel.

**Table A-9**. Power (at $\alpha = 0.20$) to detect a 20% change in total nitrogen at halved, present, and doubled levels of effort by aquatic area category (grouped by trend analysis area) and season.

| Trend analysis area | Aquatic area category[a] | Winter | | | Spring | | | Summer | | | Fall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort |
| Pool 4 | BWC | 0.63 | 0.84 | 0.97 | 0.49 | 0.68 | 0.88 | 0.47 | 0.68 | 0.88 | 0.40 | 0.56 | 0.77 |
| | MC | 0.69 | 0.90 | 0.99 | 0.46 | 0.67 | 0.87 | 0.55 | 0.77 | 0.94 | 0.26 | 0.36 | 0.51 |
| | SC | 0.99 | >0.99 | >0.99 | 0.30 | 0.41 | 0.58 | 0.61 | 0.81 | 0.96 | 0.35 | 0.50 | 0.71 |
| Pool 8 | BWC | 0.52 | 0.72 | 0.91 | 0.68 | 0.88 | 0.99 | 0.51 | 0.71 | 0.91 | 0.78 | 0.94 | >0.99 |
| | IMP | 0.75 | 0.94 | >0.99 | 0.87 | 0.98 | >0.99 | 0.74 | 0.91 | 0.99 | 0.95 | >0.99 | >0.99 |
| | MC | >0.99 | >0.99 | >0.99 | 0.73 | 0.91 | 0.99 | 0.64 | 0.87 | 0.98 | 0.49 | 0.68 | 0.89 |
| | SC | 0.92 | 0.99 | >0.99 | 0.90 | 0.99 | >0.99 | 0.87 | 0.98 | >0.99 | 0.84 | 0.98 | >0.99 |
| Pool 13 | BWC | 0.44 | 0.62 | 0.83 | 0.69 | 0.88 | 0.99 | 0.82 | 0.97 | >0.99 | 0.80 | 0.96 | >0.99 |
| | IMP | 0.55 | 0.75 | 0.93 | 0.63 | 0.82 | 0.97 | 0.88 | 0.99 | >0.99 | 0.98 | >0.99 | >0.99 |
| | MC | 0.64 | 0.84 | 0.97 | 0.51 | 0.70 | 0.90 | 0.93 | >0.99 | >0.99 | 0.81 | 0.96 | >0.99 |
| | SC | 0.87 | 0.98 | >0.99 | 0.87 | 0.98 | >0.99 | 0.88 | 0.99 | >0.99 | 0.95 | >0.99 | >0.99 |
| Pool 26 | BWC | 0.22 | 0.30 | 0.41 | 0.39 | 0.57 | 0.78 | 0.28 | 0.39 | 0.55 | 0.47 | 0.67 | 0.87 |
| | IMP | 0.27 | 0.39 | 0.56 | 0.37 | 0.54 | 0.75 | 0.51 | 0.75 | 0.93 | 0.52 | 0.74 | 0.93 |
| | MC | 0.49 | 0.70 | 0.90 | 0.62 | 0.81 | 0.96 | 0.58 | 0.79 | 0.95 | 0.69 | 0.91 | 0.99 |
| | SC | 0.51 | 0.71 | 0.91 | 0.67 | 0.88 | 0.98 | 0.80 | 0.96 | >0.99 | 0.97 | >0.99 | >0.99 |
| Open River | MC | 0.81 | 0.96 | >0.99 | 0.80 | 0.96 | >0.99 | 0.92 | 0.99 | >0.99 | 0.81 | 0.96 | >0.99 |
| | SC | 0.66 | 0.87 | 0.98 | 0.99 | >0.99 | >0.99 | 0.58 | 0.79 | 0.95 | 0.57 | 0.79 | 0.95 |
| La Grange Pool | BWC | 0.40 | 0.58 | 0.79 | 0.86 | 0.98 | >0.99 | 0.94 | >0.99 | >0.99 | 0.72 | 0.91 | 0.99 |
| | MC | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | 0.73 | 0.91 | 0.99 | >0.99 | >0.99 | >0.99 |
| | SC | 0.98 | >0.99 | >0.99 | >0.99 | >0.99 | >0.99 | 0.72 | 0.89 | 0.99 | 0.81 | 0.96 | >0.99 |

[a]BWC = backwater contiguous lake, IMP = backwater contiguous impounded, MC = main channel, SC = side channel.

**Table A-10.** Power (at $\alpha = 0.20$) to detect a 20% change in nitrate/nitrite at halved, present, and doubled levels of effort by aquatic area category (grouped by trend analysis area) and season.

| Trend analysis area | Aquatic area category[a] | Winter | | | Spring | | | Summer | | | Fall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort | Halved effort | Present effort | Doubled effort |
| Pool 4 | BWC | 0.36 | 0.50 | 0.70 | 0.29 | 0.39 | 0.56 | 0.25 | 0.35 | 0.49 | 0.24 | 0.32 | 0.44 |
| | MC | 0.99 | >0.99 | >0.99 | 0.42 | 0.62 | 0.83 | 0.42 | 0.59 | 0.80 | 0.17 | 0.21 | 0.27 |
| | SC | >0.99 | >0.99 | >0.99 | 0.58 | 0.77 | 0.94 | 0.35 | 0.49 | 0.69 | 0.20 | 0.26 | 0.35 |
| Pool 8 | BWC | 0.37 | 0.54 | 0.75 | 0.26 | 0.35 | 0.49 | 0.26 | 0.34 | 0.48 | 0.22 | 0.29 | 0.40 |
| | IMP | 0.54 | 0.76 | 0.94 | 0.64 | 0.83 | 0.97 | 0.69 | 0.89 | 0.99 | 0.58 | 0.79 | 0.95 |
| | MC | 0.99 | >0.99 | >0.99 | 0.50 | 0.68 | 0.88 | 0.48 | 0.66 | 0.87 | 0.51 | 0.69 | 0.89 |
| | SC | 0.94 | >0.99 | >0.99 | 0.57 | 0.79 | 0.95 | 0.74 | 0.92 | >0.99 | 0.34 | 0.48 | 0.67 |
| Pool 13 | BWC | 0.22 | 0.29 | 0.40 | 0.40 | 0.56 | 0.78 | 0.27 | 0.36 | 0.51 | 0.29 | 0.39 | 0.55 |
| | IMP | 0.73 | 0.91 | >0.99 | 0.30 | 0.40 | 0.57 | 0.41 | 0.57 | 0.78 | 0.87 | 0.98 | >0.99 |
| | MC | 0.99 | >0.99 | >0.99 | 0.26 | 0.34 | 0.48 | 0.56 | 0.76 | 0.94 | 0.60 | 0.79 | 0.95 |
| | SC | 0.83 | 0.97 | >0.99 | 0.50 | 0.69 | 0.89 | 0.23 | 0.30 | 0.42 | 0.56 | 0.79 | 0.95 |
| Pool 26 | BWC | 0.15 | 0.19 | 0.23 | 0.17 | 0.21 | 0.27 | 0.14 | 0.17 | 0.20 | 0.15 | 0.17 | 0.21 |
| | IMP | 0.71 | 0.93 | >0.99 | 0.36 | 0.53 | 0.74 | 0.29 | 0.39 | 0.55 | 0.29 | 0.42 | 0.59 |
| | MC | 0.82 | 0.97 | >0.99 | 0.41 | 0.56 | 0.77 | 0.54 | 0.73 | 0.92 | 0.91 | 0.99 | >0.99 |
| | SC | 0.30 | 0.41 | 0.58 | 0.42 | 0.59 | 0.80 | 0.59 | 0.80 | 0.96 | 0.81 | 0.96 | >0.99 |
| Open River | MC | >0.99 | >0.99 | >0.99 | 0.53 | 0.74 | 0.92 | >0.99 | >0.99 | >0.99 | 0.64 | 0.85 | 0.98 |
| | SC | 0.78 | 0.94 | >0.99 | 0.80 | 0.96 | >0.99 | 0.95 | >0.99 | >0.99 | 0.27 | 0.37 | 0.53 |
| La Grange Pool | BWC | 0.26 | 0.35 | 0.50 | 0.38 | 0.54 | 0.75 | 0.27 | 0.36 | 0.51 | 0.14 | 0.16 | 0.19 |
| | MC | >0.99 | >0.99 | >0.99 | 0.20 | 0.26 | 0.35 | 0.56 | 0.78 | 0.95 | >0.99 | >0.99 | >0.99 |
| | SC | 0.99 | >0.99 | >0.99 | 0.99 | >0.99 | >0.99 | 0.45 | 0.65 | 0.86 | 0.24 | 0.29 | 0.41 |

[a]BWC = backwater contiguous lake, IMP = backwater contiguous impounded, MC = main channel, SC = side channel.

# Appendix B. List of Fish Collected by the Long Term Resource Monitoring Program

**Table B.** List of fish collected by the Long Term Resource Monitoring Program, arranged phylogenetically by family, then alphabetically by genus and species. Hybrids are listed after their respective genera. Nomenclature follows Robins et al. (1991).

| Common name | Family name | Scientific name |
|---|---|---|
| | **Petromyzontidae** | |
| Chestnut lamprey | | *Ichthyomyzon castaneus* |
| Silver lamprey | | *I. unicuspis* |
| American brook lamprey | | *Lampetra appendix* |
| | **Acipenseridae** | |
| Lake sturgeon | | *Acipenser fulvescens* |
| Pallid sturgeon | | *Scaphirhynchus albus* |
| Shovelnose sturgeon | | *S. platorynchus* |
| Pallid sturgeon × Shovelnose sturgeon | | *S. albus* × *S. platorynchus* |
| | **Polyodontidae** | |
| Paddlefish | | *Polyodon spathula* |
| | **Lepisosteidae** | |
| Spotted gar | | *Lepisosteus oculatus* |
| Longnose gar | | *L. osseus* |
| Shortnose gar | | *L. platostomus* |
| | **Amiidae** | |
| Bowfin | | *Amia calva* |
| | **Hiodontidae** | |
| Goldeye | | *Hiodon alosoides* |
| Mooneye | | *H. tergisus* |
| | **Anguillidae** | |
| American eel | | *Anguilla rostrata* |
| | **Clupeidae** | |
| Skipjack herring | | *Alosa chrysochloris* |
| Gizzard shad | | *Dorosoma cepedianum* |
| Threadfin shad | | *D. petenense* |
| | **Cyprinidae** | |
| Central stoneroller | | *Campostoma anomalum* |
| Goldfish | | *Carassius auratus* |
| Grass carp | | *Ctenopharyngodon idella* |
| Red shiner | | *Cyprinella lutrensis* |
| Spotfin shiner | | *C. spiloptera* |
| Blacktail shiner | | *C. venusta* |
| Common carp | | *Cyprinus carpio* |

**Table B.** Continued

| Common name | Family name | Scientific name |
|---|---|---|
| Goldfish × common carp | | *Carassius auratus* × *C. carpio* |
| Western silvery minnow | | *Hybognathus argyritis* |
| Brassy minnow | | *H. hankinsoni* |
| Mississippi silvery minnow | | *H. nuchalis* |
| Plains minnow | | *H. placitus* |
| Silver carp | | *Hypopthalmichthys molitrix* |
| Bighead carp | | *H. nobilis* |
| Striped shiner | | *Luxilus chrysocephalus* |
| Bleeding shiner | | *Luxilus zonatus* |
| Speckled chub | | *Macrhybopsis aestivalis* |
| Sturgeon chub | | *M. gelida* |
| Sicklefin chub | | *M. meeki* |
| Silver chub | | *M. storeriana* |
| Hornyhead chub | | *Nocomis biguttatus* |
| Golden shiner | | *Notemigonus crysoleucas* |
| Bigeye chub | | *Notropis amblops* |
| Pallid shiner | | *N. amnis* |
| Emerald shiner | | *N. atherinoides* |
| River shiner | | *N. blennius* |
| Bigeye shiner | | *N. boops* |
| Ghost shiner | | *N. buchanani* |
| Spottail shiner | | *N. hudsonius* |
| Ozark minnow | | *N. nubilus* |
| Silverband shiner | | *N. shumardi* |
| Sand shiner | | *N. stramineus* |
| Weed shiner | | *N. texanus* |
| Mimic shiner | | *N. volucellus* |
| Channel shiner | | *N. wickliffi* |
| Pugnose minnow | | *Opsopoeodus emiliae* |
| Suckermouth minnow | | *Phenacobius mirabilis* |
| Southern redbelly dace | | *P. erythrogaster* |
| Bluntnose minnow | | *Pimephales notatus* |
| Fathead minnow | | *P. promelas* |
| Bullhead minnow | | *P. vigilax* |
| Blacknose dace | | *Rhinichthys atratulus* |
| Creek chub | | *Semotilus atromaculatus* |
| | **Catostomidae** | |
| River carpsucker | | *Carpiodes carpio* |
| Quillback | | *C. cyprinus* |
| Highfin carpsucker | | *C. velifer* |
| White sucker | | *C. commersoni* |
| Blue sucker | | *Cycleptus elongatus* |
| Creek chubsucker | | *Erimyzon oblongus* |
| Northern hog sucker | | *Hypentelium nigricans* |
| Smallmouth buffalo | | *Ictiobus bubalus* |
| Bigmouth buffalo | | *I. cyprinellus* |
| Black buffalo | | *I. niger* |
| Spotted sucker | | *Minytrema melanops* |
| Silver redhorse | | *Moxostoma anisurum* |
| River redhorse | | *M. carinatum* |
| Golden redhorse | | *M. erythrurum* |
| Shorthead redhorse | | *M. macrolepidotum* |

**Table B.** Continued

| Common name | Family name | Scientific name |
|---|---|---|
| | **Ictaluridae** | |
| Black bullhead | | *Ameiurus melas* |
| Yellow bullhead | | *A. natalis* |
| Brown bullhead | | *A. nebulosus* |
| Blue catfish | | *Ictalurus furcatus* |
| Channel catfish | | *I. punctatus* |
| Slender madtom | | *Noturus exilis* |
| Stonecat | | *N. flavus* |
| Tadpole madtom | | *N. gyrinus* |
| Freckled madtom | | *N. nocturnus* |
| Flathead catfish | | *Pylodictis olivaris* |
| | **Esocidae** | |
| Grass pickerel | | *Esox americanus vermiculatus* |
| Northern pike | | *E. lucius* |
| Muskellunge | | *E. masquinongy* |
| Tiger muskellunge | | *E. masquinongy* × *E. lucius* |
| Chain pickerel | | *E. niger* |
| | **Umbridae** | |
| Central mudminnow | | *Umbra limi* |
| | **Osmeridae** | |
| Rainbow smelt | | *Osmerus mordax* |
| | **Salmonidae** | |
| Brown trout | | *Salmo trutta* |
| | **Percopsidae** | |
| Trout-perch | | *Percopsis omiscomaycus* |
| | **Aphredoderidae** | |
| Pirate perch | | *Aphredoderus sayanus* |
| | **Gadidae** | |
| Burbot | | *Lota lota* |
| | **Cyprinodontidae** | |
| Northern studfish | | *Fundulus catenatus* |
| Starhead topminnow | | *F. dispar* |
| Blackstripe topminnow | | *F. notatus* |
| Blackspotted topminnow | | *F. olivaceus* |

**Table B.** Continued

| Common name | Family name | Scientific name |
|---|---|---|
| | **Poeciliidae** | |
| Western mosquitofish | | *Gambusia affinis* |
| | **Atherinidae** | |
| Brook silverside | | *Labidesthes sicculus* |
| Inland silverside | | *Menidia beryllina* |
| | **Gasterosteidae** | |
| Brook stickleback | | *Culaea inconstans* |
| | **Percichthyidae** | |
| White perch | | *Morone americana* |
| White bass | | *M. chrysops* |
| Yellow bass | | *M. mississippiensis* |
| Striped bass | | *M. saxatilis* |
| White bass × striped bass | | *M. chrysops* × *M. saxatilis* |
| | **Centrarchidae** | |
| Shadow bass | | *Ambloplites ariommus* |
| Rock bass | | *A. rupestris* |
| Flier | | *Centrarchus macropterus* |
| Green sunfish | | *Lepomis cyanellus* |
| Pumpkinseed | | *L. gibbosus* |
| Warmouth | | *L. gulosus* |
| Orangespotted sunfish | | *L. humilis* |
| Bluegill | | *L. macrochirus* |
| Longear sunfish | | *L. megalotis* |
| Redear sunfish | | *L. microlophus* |
| Green sunfish × pumpkinseed | | *L. cyanellus* × *L. gibbosus* |
| Green sunfish × warmouth | | *L. cyanellus* × *L. gulosus* |
| Green sunfish × orangespotted sunfish | | *L. cyanellus* × *L. humilis* |
| Green sunfish × bluegill | | *L. cyanellus* × *L. macrochirus* |
| Pumpkinseed × warmouth | | *L. gibbosus* × *L. gulosus* |
| Pumpkinseed × orangespotted sunfish | | *L. gibbosus* × *L. humilis* |
| Pumpkinseed × bluegill | | *L. gibbosus* × *L. macrochirus* |
| Orangespotted sunfish × longear sunfish | | *L. humilis* × *L. megalotis* |
| Bluegill × warmouth | | *L. macrochirus* × *L. gulosus* |
| Bluegill × orangespotted sunfish | | *L. macrochirus* × *L. humilis* |
| Bluegill × longear sunfish | | *L. macrochirus* × *L. megalotis* |
| Bluegill × redear sunfish | | *L. macrochirus* × *L. microlophus* |
| Smallmouth bass | | *Micropterus dolomieu* |
| Spotted bass | | *M. punctulatus* |
| Largemouth bass | | *M. salmoides* |
| White crappie | | *Pomoxis annularis* |
| Black crappie | | *P. nigromaculatus* |
| White crappie × black crappie | | *P. annularis* × *P. nigromaculatus* |

**Table B.** Continued

| Common name | Family name | Scientific name |
|---|---|---|
| | **Percidae** | |
| Crystal darter | | *Crystallaria asprella* |
| Western sand darter | | *Ammocrypta clara* |
| Mud darter | | *Etheostoma asprigene* |
| Greenside darter | | *E. blennioides* |
| Bluntnose darter | | *E. chlorosomum* |
| Iowa darter | | *E. exile* |
| Fantail darter | | *E. flabellare* |
| Slough darter | | *E. gracile* |
| Johnny darter | | *E. nigrum* |
| Banded darter | | *E. zonale* |
| Yellow perch | | *Perca flavescens* |
| Logperch | | *Percina caprodes* |
| Blackside darter | | *P. maculata* |
| Slenderhead darter | | *P. phoxocephala* |
| Dusky darter | | *P. sciera* |
| River darter | | *P. shumardi* |
| Sauger | | *Stizostedion canadense* |
| Walleye | | *S. vitreum* |
| Sauger × walleye | | *S. canadense* × *S. vitreum* |
| | **Sciaenidae** | |
| Freshwater drum | | *Aplodinotus grunniens* |

# Appendix C. Power Analyses for Fish

Appendix C contains six tables, one for each trend analysis area, listing statistical power (at $\alpha = 0.05$) to detect a 20% annual change in mean catch-per-unit-effort (CPUE) for fish species. Within each table, the fish listed first (*in boldface*) are the 14 species of special interest to Long Term Resource Monitoring Program partners (black crappie, bluegill, channel catfish, common carp, emerald shiner, freshwater drum, gizzard shad, largemouth bass, northern pike, sauger, smallmouth buffalo, walleye, white bass, and white crappie). The remaining species listed in each table are those for which power to detect a 20% change in mean CPUE was at least 0.50 for one or more sampling gears at doubled the present level of effort. All power values of 0.50 or greater are listed in bold type.

**Table C-1.** For Navigation Pool 4, statistical power (at $\alpha$ = 0.05) to detect a 20% annual change in mean catch-per-unit-effort at halved, present, and doubled levels of effort with eight standard sampling gears used in the Long Term Resource Monitoring Program (LTRMP). Fish were sampled from 1993 to 1999. Fish species listed include the 14 species (*in bold*) of special interest to LTRMP partners and other species for which power was at least 0.50 (*in bold*) for one or more gears at the doubled level of effort. Blank spaces indicate an aquatic area category not sampled by that gear or low power. (Shaded bars are added for readability.)

| | | Sampling gear and effort | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Aquatic area | Day electrofishing | | | Seine | | | Fyke net | | | Mini fyke net | | | Large hoop net | | | Small hoop net | | | Tandem fyke net | | | Tandem mini fyke net | | |
| Fish species | category[a] | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled |
| Black crappie | BWCO | 0.08 | 0.12 | 0.19 | | | | | | | | | | | | | | | | **0.90** | **0.99** | **0.99** | <0.01 | <0.01 | <0.01 |
| | BWCS | 0.30 | **0.53** | **0.84** | | | | **0.62** | **0.93** | **0.99** | 0.16 | 0.29 | **0.51** | | | | | | | | | | | | |
| **Bluegill** | BWCS | **0.52** | **0.81** | **0.98** | | | | 0.42 | **0.76** | **0.95** | 0.15 | 0.27 | 0.48 | | | | | | | | | | | | |
| Channel catfish | MCBU | 0.11 | 0.18 | 0.33 | | | | | | | 0.05 | 0.05 | 0.06 | 0.21 | 0.40 | **0.67** | 0.14 | 0.26 | 0.48 | | | | | | |
| | SCB | 0.10 | 0.15 | 0.27 | | | | | | | 0.05 | 0.05 | 0.06 | 0.16 | 0.32 | **0.56** | 0.20 | 0.38 | **0.67** | | | | | | |
| **Common carp** | SCB | **0.98** | **0.99** | **0.99** | | | | | | | 0.08 | 0.12 | 0.19 | 0.17 | 0.33 | **0.58** | 0.15 | 0.27 | 0.49 | | | | | | |
| Emerald shiner | MCBU | **0.52** | **0.83** | **0.99** | | | | | | | 0.08 | 0.13 | 0.22 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Freshwater drum** | BWCS | **0.50** | **0.80** | **0.98** | | | | 0.23 | 0.44 | **0.72** | 0.09 | 0.14 | 0.23 | | | | | | | | | | | | |
| | SCB | 0.27 | **0.51** | **0.82** | | | | | | | 0.09 | 0.14 | 0.24 | 0.12 | 0.21 | 0.37 | 0.09 | 0.13 | 0.23 | | | | | | |
| Gizzard shad | BWCS | 0.46 | **0.75** | **0.97** | | | | 0.09 | 0.15 | 0.25 | 0.09 | 0.14 | 0.23 | | | | | | | | | | | | |
| | MCBU | 0.22 | 0.41 | **0.70** | | | | | | | 0.06 | 0.08 | 0.11 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.28 | **0.53** | **0.84** | | | | | | | 0.07 | 0.10 | 0.15 | 0.05 | 0.05 | 0.06 | 0.00 | 0.00 | 0.00 | | | | | | |
| **Largemouth bass** | BWCS | **0.66** | **0.92** | **0.99** | | | | 0.07 | 0.10 | 0.15 | 0.07 | 0.11 | 0.17 | | | | | | | | | | | | |
| | SCB | 0.30 | **0.56** | **0.87** | | | | | | | 0.07 | 0.09 | 0.13 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Northern pike | BWCO | 0.06 | 0.07 | 0.10 | | | | | | | | | | | | | | | | 0.18 | 0.31 | **0.56** | <0.01 | <0.01 | <0.01 |
| | BWCS | 0.16 | 0.28 | **0.51** | | | | 0.19 | 0.34 | **0.60** | 0.07 | 0.09 | 0.13 | | | | | | | | | | | | |
| **Sauger** | MCBU | 0.15 | 0.27 | 0.49 | | | | | | | 0.05 | 0.06 | 0.07 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.07 | | | | | | |
| | SCB | 0.28 | **0.52** | **0.83** | | | | | | | 0.07 | 0.09 | 0.12 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Smallmouth buffalo | MCBU | **0.72** | **0.96** | **0.99** | | | | | | | <0.01 | <0.01 | <0.01 | 0.36 | **0.66** | **0.92** | 0.06 | 0.09 | 0.13 | | | | | | |
| | SCB | 0.08 | 0.13 | 0.21 | | | | | | | <0.01 | <0.01 | <0.01 | 0.17 | 0.35 | **0.60** | 0.06 | 0.07 | 0.10 | | | | | | |
| **Walleye** | MCBU | 0.18 | 0.32 | **0.57** | | | | | | | 0.05 | 0.06 | 0.07 | 0.05 | 0.05 | 0.06 | 0.05 | 0.06 | 0.06 | | | | | | |
| | SCB | 0.21 | 0.40 | **0.70** | | | | | | | 0.06 | 0.07 | 0.09 | 0.05 | 0.05 | 0.06 | 0.05 | 0.06 | 0.07 | | | | | | |
| **White bass** | MCBU | 0.36 | **0.64** | **0.91** | | | | | | | 0.09 | 0.13 | 0.23 | 0.06 | 0.07 | 0.10 | 0.05 | 0.06 | 0.06 | | | | | | |
| **White crappie** | BWCS | 0.08 | 0.11 | 0.17 | | | | 0.09 | 0.14 | 0.22 | 0.07 | 0.10 | 0.15 | | | | | | | | | | | | |
| Bowfin | BWCS | 0.22 | 0.39 | **0.68** | | | | 0.20 | 0.37 | **0.64** | 0.09 | 0.14 | 0.24 | | | | | | | | | | | | |
| **Rock bass** | BWCO | 0.07 | 0.09 | 0.13 | | | | | | | | | | | | | | | | 0.36 | **0.61** | **0.90** | <0.01 | <0.01 | <0.01 |
| Shorthead redhorse | MCBU | **0.50** | **0.81** | **0.98** | | | | | | | 0.06 | 0.07 | 0.09 | 0.08 | 0.12 | 0.20 | 0.08 | 0.12 | 0.21 | | | | | | |
| | SCB | **0.53** | **0.84** | **0.99** | | | | | | | 0.06 | 0.07 | 0.08 | 0.08 | 0.12 | 0.20 | 0.08 | 0.09 | 0.14 | | | | | | |
| Silver redhorse | BWCO | 0.22 | 0.41 | **0.70** | | | | | | | | | | | | | | | | **0.57** | **0.86** | **0.99** | <0.01 | <0.01 | <0.01 |
| | BWCS | 0.35 | **0.61** | **0.90** | | | | 0.35 | **0.63** | **0.90** | 0.10 | 0.17 | 0.29 | | | | | | | | | | | | |
| Smallmouth bass | MCBU | **0.72** | **0.96** | **0.99** | | | | | | | 0.06 | 0.08 | 0.12 | <0.01 | <0.01 | <0.01 | 0.05 | 0.06 | 0.06 | | | | | | |
| | SCB | 0.36 | **0.65** | **0.93** | | | | | | | 0.05 | 0.06 | 0.07 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Spotted sucker** | BWCS | 0.36 | **0.63** | **0.91** | | | | 0.12 | 0.21 | 0.37 | 0.05 | 0.06 | 0.08 | | | | | | | | | | | | |
| Spottail shiner | BWCS | 0.18 | 0.31 | **0.56** | | | | <0.01 | <0.01 | <0.01 | 0.10 | 0.15 | 0.26 | | | | | | | | | | | | |
| **Yellow perch** | BWCO | 0.11 | 0.19 | 0.33 | | | | | | | | | | | | | | | | 0.35 | **0.61** | **0.90** | <0.01 | <0.01 | <0.01 |
| | BWCS | **0.54** | **0.83** | **0.99** | | | | 0.14 | 0.25 | 0.45 | 0.07 | 0.09 | 0.13 | | | | | | | | | | | | |

[a]BWCO = Backwater contiguous lake offshore, BWCS = Backwater contiguous lake shoreline, MCBU = Main channel border unstructured, SCB = Side channel border.

**Table C-2.** For Navigation Pool 8, statistical power (at α = 0.05) to detect a 20% annual change in mean catch-per-unit-effort at halved, present, and doubled levels of effort with eight standard sampling gears used in the Long Term Resource Monitoring Program (LTRMP). Fish were sampled from 1993 to 1999. Fish species listed include the 14 species (*in bold*) of special interest to LTRMP partners and other species for which power was at least 0.50 (*in bold*) for one or more gears at the doubled level of effort. Blank spaces indicate an aquatic area category not sampled by that gear or low power. (Shaded bars are added for readability.)

| | Aquatic | Sampling gear and effort | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | area | Day electrofishing | | | Seine | | | Fyke net | | | Mini fyke net | | | Large hoop net | | | Small hoop net | | | Tandem fyke net | | | Tandem mini fyke net | | |
| Fish species | category[a] | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled |
| **Black crappie** | BWCO | | | | | | | | | | | | | 0.17 | 0.36 | **0.64** | 0.10 | 0.17 | 0.30 | **0.61** | **0.96** | **0.99** | 0.13 | 0.26 | .047 |
| | BWCS | 0.33 | **0.60** | **0.88** | 0.11 | 0.19 | 0.36 | **0.99** | **0.99** | **0.99** | 0.27 | 0.49 | **0.78** | | | | | | | | | | | | |
| **Bluegill** | BWCS | **0.77** | **0.97** | **0.99** | 0.26 | **0.51** | **0.85** | **0.94** | **0.99** | **0.99** | 0.49 | **0.80** | **0.98** | | | | | | | | | | | | |
| **Channel catfish** | MCBU | 0.07 | 0.10 | 0.15 | 0.05 | 0.05 | 0.05 | | | | 0.06 | 0.06 | 0.08 | 0.15 | 0.25 | 0.49 | 0.29 | **0.57** | **0.86** | | | | | | |
| | SCB | 0.09 | 0.14 | 0.24 | <0.01 | <0.01 | <0.01 | | | | <0.01 | <0.01 | <0.01 | 0.31 | **0.64** | **0.91** | 0.30 | **0.63** | **0.91** | | | | | | |
| **Common carp** | SCB | **0.88** | **0.99** | **0.99** | 0.06 | 0.07 | 0.10 | | | | 0.08 | 0.11 | 0.17 | 0.12 | 0.24 | 0.43 | 0.07 | 0.12 | 0.19 | | | | | | |
| **Emerald shiner** | MCBU | 0.40 | **0.72** | **0.95** | **0.52** | **0.86** | **0.99** | | | | 0.15 | 0.25 | 0.48 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Freshwater drum** | BWCS | 0.38 | **0.67** | **0.93** | 0.09 | 0.15 | 0.28 | 0.29 | **0.52** | **0.82** | 0.11 | 0.18 | 0.30 | | | | | | | | | | | | |
| | SCB | 0.19 | 0.34 | **0.61** | 0.10 | 0.16 | 0.28 | | | | 0.08 | 0.11 | 0.17 | 0.08 | 0.14 | 0.23 | 0.09 | 0.15 | 0.26 | | | | | | |
| **Gizzard shad** | BWCS | 0.36 | **0.64** | **0.91** | 0.08 | 0.13 | 0.23 | 0.14 | 0.22 | 0.40 | 0.12 | 0.20 | 0.35 | | | | | | | | | | | | |
| | MCBU | 0.10 | 0.17 | 0.29 | 0.07 | 0.10 | 0.15 | | | | 0.07 | 0.08 | 0.12 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.29 | **0.54** | **0.84** | 0.11 | 0.18 | 0.32 | | | | 0.07 | 0.10 | 0.14 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Largemouth bass** | BWCS | **0.71** | **0.95** | **0.99** | 0.13 | 0.24 | 0.47 | 0.14 | 0.23 | 0.41 | 0.10 | 0.16 | 0.21 | | | | | | | | | | | | |
| | SCB | **0.51** | **0.82** | **0.99** | 0.09 | 0.12 | 0.21 | | | | 0.06 | 0.08 | 0.11 | 0.05 | 0.05 | 0.06 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Northern pike** | BWCO | | | | | | | | | | | | | 0.07 | 0.11 | 0.19 | 0.05 | 0.05 | 0.06 | 0.14 | 0.32 | **0.58** | 0.06 | 0.07 | 0.08 |
| | BWCS | 0.20 | 0.36 | **0.63** | 0.09 | 0.13 | 0.24 | 0.31 | **0.54** | **0.84** | 0.07 | 0.10 | 0.16 | | | | | | | | | | | | |
| **Sauger** | MCBU | 0.13 | 0.23 | 0.43 | 0.07 | 0.10 | 0.16 | | | | 0.08 | 0.11 | 0.18 | 0.05 | 0.05 | 0.06 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.34 | **0.61** | **0.89** | 0.07 | 0.09 | 0.14 | | | | 0.06 | 0.07 | 0.09 | <0.01 | <0.01 | <0.01 | 0.05 | 0.05 | 0.06 | | | | | | |
| **Smallmouth buffalo** | MCBU | 0.07 | 0.10 | 0.16 | 0.06 | 0.07 | 0.10 | | | | 0.05 | 0.06 | 0.07 | 0.20 | 0.35 | **0.66** | 0.07 | 0.09 | 0.14 | | | | | | |
| | SCB | 0.10 | 0.16 | 0.28 | 0.05 | 0.06 | 0.06 | | | | 0.05 | 0.05 | 0.06 | 0.16 | 0.32 | **0.56** | 0.06 | 0.07 | 0.09 | | | | | | |
| **Walleye** | MCBU | 0.08 | 0.11 | 0.19 | 0.07 | 0.11 | 0.17 | | | | 0.06 | 0.07 | 0.10 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.13 | 0.22 | 0.39 | 0.06 | 0.07 | 0.10 | | | | 0.06 | 0.08 | 0.10 | 0.05 | 0.06 | 0.08 | <0.01 | <0.01 | <0.01 | | | | | | |
| **White bass** | MCBU | 0.31 | **0.59** | **0.88** | 0.20 | 0.39 | **0.66** | | | | 0.13 | 0.22 | 0.41 | 0.06 | 0.07 | 0.10 | <0.01 | <0.01 | <0.01 | | | | | | |
| **White crappie** | BWCS | 0.07 | 0.10 | 0.15 | 0.06 | 0.07 | 0.10 | 0.19 | 0.34 | **0.59** | 0.07 | 0.09 | 0.13 | | | | | | | | | | | | |
| Bowfin | BWCS | 0.19 | 0.35 | **0.62** | 0.05 | 0.05 | 0.05 | 0.47 | **0.76** | **0.97** | 0.06 | 0.08 | 0.10 | | | | | | | | | | | | |
| Bullhead minnow | MCBU | 0.21 | 0.39 | **0.68** | 0.33 | **0.63** | **0.90** | | | | 0.12 | 0.18 | 0.35 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | **0.51** | **0.82** | **0.98** | 0.38 | **0.66** | **0.93** | | | | 0.33 | **0.60** | **0.88** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Channel shiner | MCBU | 0.12 | 0.21 | 0.38 | 0.21 | 0.41 | **0.69** | | | | 0.10 | 0.15 | 0.27 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Golden redhorse | SCB | 0.44 | **0.75** | **0.96** | 0.06 | 0.06 | 0.07 | | | | <0.01 | <0.01 | <0.01 | 0.06 | 0.07 | 0.09 | 0.05 | 0.06 | 0.07 | | | | | | |
| | MCBU | 0.23 | 0.44 | **0.74** | <0.01 | <0.01 | <0.01 | | | | <0.01 | <0.01 | <0.01 | 0.05 | 0.06 | 0.06 | 0.05 | 0.06 | 0.07 | | | | | | |
| Johnny darter | BWCS | 0.26 | 0.47 | **0.77** | 0.16 | 0.30 | **0.58** | <0.01 | <0.01 | <0.01 | 0.17 | 0.30 | **0.53** | | | | | | | | | | | | |
| | SCB | 0.26 | 0.47 | **0.77** | 0.15 | 0.27 | **0.50** | | | | 0.15 | 0.27 | 0.47 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Logperch | BWCS | 0.24 | 0.43 | **0.73** | 0.09 | 0.14 | 0.25 | <0.01 | <0.01 | <0.01 | 0.09 | 0.13 | 0.21 | | | | | | | | | | | | |
| | MCBU | 0.25 | 0.47 | **0.78** | 0.17 | 0.32 | **0.56** | | | | 0.11 | 0.17 | 0.31 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Longnose gar | BWCS | 0.07 | 0.10 | 0.14 | 0.05 | 0.06 | 0.07 | 0.23 | **0.51** | **0.70** | 0.08 | 0.12 | 0.19 | | | | | | | | | | | | |
| Orangespotted sunfish | BWCS | 0.23 | 0.43 | **0.72** | 0.06 | 0.08 | 0.11 | 0.08 | 0.12 | 0.19 | 0.12 | 0.19 | 0.34 | | | | | | | | | | | | |
| Pugnose minnow | BWCS | 0.24 | 0.45 | **0.74** | 0.16 | 0.31 | **0.59** | <0.01 | <0.01 | <0.01 | 0.27 | **0.50** | **0.78** | | | | | | | | | | | | |
| Pumpkinseed | BWCS | 0.14 | 0.25 | 0.45 | 0.05 | 0.05 | 0.05 | 0.17 | 0.28 | **0.51** | 0.12 | 0.19 | 0.33 | | | | | | | | | | | | |
| River shiner | MCBU | 0.33 | **0.61** | **0.90** | 0.48 | **0.82** | **0.98** | | | | 0.12 | 0.19 | 0.37 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.28 | **0.52** | **0.82** | 0.23 | 0.41 | **0.71** | | | | 0.09 | 0.13 | 0.22 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Rock bass | BWCS | 0.27 | **0.50** | **0.80** | 0.10 | 0.17 | 0.33 | 0.19 | 0.33 | **0.58** | 0.11 | 0.18 | 0.32 | | | | | | | | | | | | |
| | SCB | 0.41 | **0.71** | **0.95** | 0.08 | 0.12 | 0.21 | | | | 0.10 | 0.16 | 0.27 | <0.01 | <0.01 | <0.01 | 0.07 | 0.09 | 0.15 | | | | | | |
| Shorthead redhorse | MCBU | 0.41 | **0.72** | **0.96** | 0.07 | 0.11 | 0.17 | | | | 0.10 | 0.15 | 0.28 | 0.10 | 0.15 | 0.29 | 0.10 | 0.16 | 0.27 | | | | | | |
| | SCB | **0.78** | **0.98** | **0.99** | 0.08 | 0.12 | 0.20 | | | | 0.08 | 0.12 | 0.20 | 0.11 | 0.21 | 0.37 | 0.10 | 0.18 | 0.33 | | | | | | |
| Shortnose gar | BWCS | 0.08 | 0.12 | 0.20 | 0.05 | 0.06 | 0.06 | **0.59** | **0.87** | **0.99** | 0.15 | 0.25 | 0.45 | | | | | | | | | | | | |
| Silver redhorse | MCBU | 0.33 | **0.61** | **0.90** | 0.08 | 0.11 | 0.18 | | | | 0.06 | 0.08 | 0.11 | 0.08 | 0.10 | 0.18 | 0.06 | 0.08 | 0.10 | | | | | | |
| | SCB | **0.75** | **0.97** | **0.99** | 0.08 | 0.12 | 0.20 | | | | 0.06 | 0.08 | 0.11 | 0.08 | 0.11 | 0.18 | 0.06 | 0.07 | 0.10 | | | | | | |
| Smallmouth bass | MCBU | **0.66** | **0.94** | **0.99** | 0.13 | 0.23 | 0.41 | | | | 0.06 | 0.06 | 0.08 | 0.05 | 0.06 | 0.07 | 0.05 | 0.06 | 0.06 | | | | | | |
| | SCB | **0.54** | **0.84** | **0.99** | 0.08 | 0.12 | 0.20 | | | | 0.08 | 0.11 | 0.16 | 0.06 | 0.06 | 0.08 | 0.05 | 0.05 | 0.06 | | | | | | |
| Spotfin shiner | SCB | **0.73** | **0.96** | **0.99** | 0.42 | **0.71** | **0.96** | | | | 0.34 | **0.62** | **0.89** | <0.01 | <0.01 | <0.01 | 0.05 | 0.06 | 0.07 | | | | | | |
| | MCBU | 0.49 | **0.82** | **0.99** | **0.52** | **0.86** | **0.99** | | | | 0.21 | 0.37 | **0.68** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.13 | | | | | | |
| Spotted sucker | BWCS | 0.44 | **0.74** | **0.96** | 0.06 | 0.08 | 0.13 | 0.18 | 0.32 | **0.56** | 0.06 | 0.07 | 0.10 | | | | | | | | | | | | |
| Yellow perch | BWCO | | | | | | | | | | | | | 0.05 | 0.06 | 0.06 | 0.06 | 0.08 | 0.12 | 0.16 | 0.37 | **0.66** | 0.08 | 0.12 | 0.20 |
| | BWCS | 0.39 | **0.69** | **0.94** | 0.08 | 0.12 | 0.21 | 0.28 | 0.49 | **0.79** | 0.10 | 0.15 | 0.26 | | | | | | | | | | | | |

[a]BWCO = Backwater contiguous lake offshore, BWCS = Backwater contiguous lake shoreline, MCBU = Main channel border unstructured, SCB = Side channel border.

**Table C-3.** For Navigation Pool 13, statistical power (at α = 0.05) to detect a 20% annual change in mean catch-per-unit-effort at halved, present, and doubled levels of effort with eight standard sampling gears used in the Long Term Resource Monitoring Program (LTRMP). Fish were sampled from 1993 to 1999. Fish species listed include the 14 species (*in bold*) of special interest to LTRMP partners and other species for which power was at least 0.50 (*in bold*) for one or more gears at the doubled level of effort. Blank spaces indicate an aquatic area category not sampled by that gear or low power. (Shaded bars are added for readability.)

| Fish species | Aquatic area category[a] | Day electrofishing | | | Seine | | | Fyke net | | | Mini fyke net | | | Large hoop net | | | Small hoop net | | | Tandem fyke net | | | Tandem mini fyke net | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled |
| **Black crappie** | BWCO | | | | | | | | | | | | | 0.20 | 0.37 | **0.63** | 0.12 | 0.20 | 0.38 | **0.66** | **0.95** | **0.99** | 0.15 | 0.28 | **0.51** |
| | BWCS | 0.39 | **0.68** | **0.93** | 0.07 | 0.10 | 0.16 | **0.87** | **0.99** | **0.99** | 0.23 | 0.42 | **0.72** | | | | | | | | | | | | |
| **Bluegill** | BWCS | **0.94** | **0.99** | **0.99** | 0.19 | 0.36 | **0.64** | **0.88** | **0.99** | **0.99** | **0.58** | **0.88** | **0.99** | | | | | | | | | | | | |
| **Channel catfish** | MCBU | 0.13 | 0.23 | 0.42 | 0.11 | 0.18 | 0.33 | | | | 0.07 | 0.10 | 0.14 | 0.07 | 0.11 | 0.17 | 0.28 | **0.57** | 0.18 | | | | | | |
| | SCB | 0.07 | 0.12 | 0.21 | 0.06 | 0.07 | 0.10 | | | | 0.06 | 0.07 | 0.09 | 0.11 | 0.18 | 0.32 | 0.21 | 0.41 | **0.72** | | | | | | |
| **Common carp** | SCB | **0.51** | **0.91** | **0.99** | <0.01 | <0.01 | <0.01 | | | | 0.06 | 0.08 | 0.11 | 0.08 | 0.11 | 0.18 | 0.06 | 0.06 | 0.08 | | | | | | |
| **Emerald shiner** | MCBU | **0.70** | **0.96** | **0.99** | 0.41 | **0.73** | **0.96** | | | | 0.29 | **0.55** | **0.83** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Freshwater drum** | BWCS | **0.53** | **0.84** | **0.99** | 0.11 | 0.18 | 0.33 | 0.29 | **0.50** | **0.80** | 0.14 | 0.25 | 0.46 | | | | | | | | | | | | |
| | SCB | 0.15 | 0.33 | **0.62** | 0.08 | 0.10 | 0.18 | | | | 0.08 | 0.13 | 0.23 | 0.13 | 0.23 | 0.41 | 0.09 | 0.15 | 0.27 | | | | | | |
| **Gizzard shad** | BWCS | **0.60** | **0.89** | **0.99** | 0.13 | 0.23 | 0.42 | 0.25 | 0.44 | **0.73** | 0.14 | 0.24 | 0.43 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | MCBU | 0.22 | 0.43 | **0.73** | 0.09 | 0.13 | 0.22 | | | | 0.05 | 0.05 | 0.06 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.13 | 0.26 | **0.50** | 0.06 | 0.07 | 0.10 | | | | 0.06 | 0.07 | 0.10 | 0.05 | 0.06 | 0.06 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Largemouth bass** | BWCS | **0.98** | **0.99** | **0.99** | 0.07 | 0.10 | 0.16 | 0.28 | **0.50** | **0.80** | 0.18 | 0.32 | **0.57** | | | | | | | | | | | | |
| | SCB | 0.17 | 0.39 | **0.71** | 0.08 | 0.10 | 0.18 | | | | 0.06 | 0.08 | 0.11 | <0.01 | <0.01 | <0.01 | 0.05 | 0.05 | 0.05 | | | | | | |
| **Northern pike** | BWCO | | | | | | | | | | | | | 0.06 | 0.06 | 0.08 | <0.01 | <0.01 | <0.01 | 0.09 | 0.15 | 0.25 | 0.05 | 0.06 | 0.06 |
| | BWCS | 0.08 | 0.11 | 0.17 | <0.01 | <0.01 | <0.01 | 0.15 | 0.26 | 0.47 | 0.06 | 0.08 | 0.11 | | | | | | | | | | | | |
| **Sauger** | BWCS | 0.29 | **0.53** | **0.83** | <0.01 | <0.01 | <0.01 | 0.09 | 0.14 | 0.24 | 0.06 | 0.07 | 0.08 | | | | | | | | | | | | |
| | SCB | 0.10 | 0.19 | 0.36 | 0.06 | 0.07 | 0.10 | | | | 0.05 | 0.05 | 0.06 | <0.01 | <0.01 | <0.01 | 0.05 | 0.06 | 0.06 | | | | | | |
| **Smallmouth buffalo** | MCBU | 0.08 | 0.12 | 0.21 | <0.01 | <0.01 | <0.01 | | | | 0.05 | 0.06 | 0.07 | 0.18 | 0.35 | **0.61** | 0.06 | 0.07 | 0.10 | | | | | | |
| | SCB | 0.06 | 0.08 | 0.13 | <0.01 | <0.01 | <0.01 | | | | 0.24 | 0.48 | **0.78** | 0.07 | 0.09 | 0.14 | | | | | | | | | |
| **Walleye** | MCBU | 0.11 | 0.18 | 0.32 | 0.06 | 0.07 | 0.10 | | | | 0.07 | 0.10 | 0.14 | 0.05 | 0.05 | 0.06 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.06 | 0.08 | 0.11 | <0.01 | <0.01 | <0.01 | | | | 0.05 | 0.05 | 0.06 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **White bass** | MCBU | 0.39 | **0.70** | **0.95** | 0.06 | 0.07 | 0.10 | | | | 0.10 | 0.17 | 0.30 | 0.06 | 0.07 | 0.10 | 0.06 | 0.07 | 0.09 | | | | | | |
| **White crappie** | BWCS | 0.30 | **0.55** | **0.84** | 0.06 | 0.07 | 0.10 | 0.43 | **0.71** | **0.95** | 0.15 | 0.27 | 0.49 | | | | | | | | | | | | |
| Bowfin | BWCS | 0.17 | 0.30 | **0.53** | <0.01 | <0.01 | <0.01 | 0.24 | 0.43 | **0.72** | 0.12 | 0.19 | 0.34 | | | | | | | | | | | | |
| Bullhead minnow | MCBU | 0.08 | 0.13 | 0.21 | 0.21 | 0.39 | **0.69** | | | | 0.15 | 0.28 | 0.49 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | BWCS | 0.23 | 0.43 | **0.72** | 0.24 | 0.47 | **0.78** | <0.01 | <0.01 | <0.01 | 0.27 | 0.49 | **0.80** | | | | | | | | | | | | |
| Channel shiner | MCBU | 0.12 | 0.20 | 0.37 | 0.16 | 0.30 | **0.54** | | | | 0.21 | 0.41 | **0.69** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Golden shiner | BWCO | | | | | | | | | | | | | 0.06 | 0.08 | 0.11 | 0.06 | 0.07 | 0.10 | 0.20 | 0.39 | **0.67** | 0.08 | 0.11 | 0.17 |
| Johnny darter | BWCS | 0.06 | 0.08 | 0.11 | 0.34 | **0.64** | **0.92** | <0.01 | <0.01 | <0.01 | 0.15 | 0.27 | 0.49 | | | | | | | | | | | | |
| | SCB | 0.05 | 0.05 | 0.06 | 0.10 | 0.16 | 0.32 | | | | 0.06 | 0.07 | 0.10 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Orangespotted sunfish | BWCS | 0.40 | **0.70** | **0.94** | 0.13 | 0.23 | 0.43 | 0.11 | 0.18 | 0.31 | 0.27 | 0.49 | **0.80** | | | | | | | | | | | | |
| Pumpkinseed | BWCS | 0.20 | 0.35 | **0.62** | 0.06 | 0.07 | 0.10 | 0.15 | 0.26 | 0.47 | 0.09 | 0.13 | 0.23 | | | | | | | | | | | | |
| River carpsucker | BWCS | 0.20 | 0.37 | **0.64** | <0.01 | <0.01 | <0.01 | 0.18 | 0.31 | **0.55** | 0.07 | 0.09 | 0.13 | | | | | | | | | | | | |
| River shiner | MCBU | 0.26 | 0.49 | **0.80** | 0.32 | **0.60** | **0.90** | | | | 0.25 | 0.49 | **0.78** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.12 | 0.25 | 0.48 | 0.16 | 0.30 | **0.58** | | | | 0.08 | 0.13 | 0.22 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| River darter | BWCS | 0.05 | 0.05 | 0.06 | 0.26 | **0.50** | **0.81** | <0.01 | <0.01 | <0.01 | 0.10 | 0.15 | 0.26 | | | | | | | | | | | | |
| Shorthead redhorse | MCBU | 0.07 | 0.31 | **0.56** | <0.01 | <0.01 | <0.01 | | | | 0.07 | 0.09 | 0.13 | 0.06 | 0.08 | 0.11 | 0.05 | 0.06 | 0.07 | | | | | | |
| | SCB | 0.09 | 0.15 | 0.27 | <0.01 | <0.01 | <0.01 | | | | 0.05 | 0.05 | 0.06 | 0.06 | 0.09 | 0.12 | 0.06 | 0.08 | 0.11 | | | | | | |
| Shortnose gar | BWCS | 0.08 | 0.12 | 0.20 | <0.01 | <0.01 | <0.01 | 0.32 | **0.56** | **0.86** | 0.15 | 0.27 | 0.49 | | | | | | | | | | | | |
| | BWCO | | | | | | | | | | | | | 0.07 | 0.09 | 0.12 | 0.05 | 0.06 | 0.06 | 0.18 | 0.36 | **0.61** | 0.08 | 0.12 | 0.20 |
| Silver chub | BWCS | 0.09 | 0.13 | 0.21 | 0.19 | 0.36 | **0.64** | <0.01 | <0.01 | <0.01 | 0.07 | 0.10 | 0.16 | | | | | | | | | | | | |
| | MCBU | 0.08 | 0.12 | 0.20 | 0.23 | 0.44 | **0.74** | | | | 0.06 | 0.07 | 0.09 | <0.01 | <0.01 | <0.01 | 0.05 | 0.06 | 0.06 | | | | | | |

[a]BWCO = Backwater contiguous lake offshore, BWCS = Backwater contiguous lake shoreline, MCBU = Main channel border unstructured, SCB = Side channel border.

**Table C-4.** For Navigation Pool 26, statistical power (at α = 0.05) to detect a 20% annual change in mean catch-per-unit-effort at halved, present, and doubled levels of effort with eight standard sampling gears used in the Long Term Resource Monitoring Program (LTRMP). Fish were sampled from 1993 to 1999. Fish species listed include the 14 species (*in bold*) of special interest to LTRMP partners and other species for which power was at least 0.50 (*in bold*) for one or more gears at the doubled level of effort. Blank spaces indicate an aquatic area category not sampled by that gear or low power. (Shaded bars are added for readability.)

| | Aquatic area | Sampling gear and effort | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Day electrofishing | | | Seine | | | Fyke net | | | Mini fyke net | | | Large hoop net | | | Small hoop net | | | Tandem fyke net | | | Tandem mini fyke net | | |
| Fish species | category[a] | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled |
| **Black crappie** | BWCS | 0.15 | 0.28 | 0.49 | | | | 0.36 | **0.73** | **0.96** | 0.10 | 0.17 | 0.32 | | | | | | | | | | | | |
| | IMPS | 0.09 | 0.13 | 0.23 | | | | 0.26 | **0.58** | **0.87** | 0.09 | 0.17 | 0.31 | | | | | | | | | | | | |
| **Bluegill** | BWCS | **0.54** | **0.88** | **0.99** | | | | 0.39 | **0.76** | **0.97** | 0.14 | 0.25 | 0.47 | | | | | | | | | | | | |
| | IMPS | **0.63** | **0.90** | **0.99** | | | | 0.14 | 0.29 | **0.51** | 0.17 | 0.38 | **0.70** | | | | | | | | | | | | |
| **Channel catfish** | MCBU | **0.58** | **0.87** | **0.99** | | | | | | | 0.09 | 0.16 | 0.27 | 0.26 | 0.47 | **0.77** | 0.44 | **0.73** | **0.96** | | | | | | |
| | SCB | **0.50** | **0.80** | **0.98** | | | | 0.06 | 0.08 | 0.12 | 0.13 | 0.21 | 0.38 | 0.24 | 0.47 | **0.78** | 0.40 | **0.69** | **0.94** | | | | | | |
| **Common carp** | SCB | **0.99** | **0.99** | **0.99** | | | | 0.06 | 0.08 | 0.11 | 0.08 | 0.11 | 0.17 | 0.37 | **0.68** | **0.94** | 0.17 | 0.29 | **0.53** | | | | | | |
| **Emerald shiner** | MCBU | 0.31 | 0.54 | **0.85** | | | | | | | 0.11 | 0.22 | 0.38 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | **0.54** | **0.83** | **0.99** | | | | <0.01 | <0.01 | <0.01 | 0.32 | **0.56** | **0.86** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Freshwater drum** | BWCS | **0.65** | **0.94** | **0.99** | | | | 0.13 | 0.25 | 0.46 | 0.09 | 0.15 | 0.26 | | | | | | | | | | | | |
| | SCB | **0.64** | **0.91** | **0.99** | | | | 0.11 | 0.19 | 0.36 | 0.14 | 0.24 | 0.44 | 0.12 | 0.21 | 0.38 | 0.09 | 0.12 | 0.21 | | | | | | |
| **Gizzard shad** | BWCS | **0.93** | **0.99** | **0.99** | | | | 0.20 | 0.43 | **0.73** | 0.17 | 0.34 | **0.61** | | | | | | | | | | | | |
| | MCBU | **0.88** | **0.99** | **0.99** | | | | | | | 0.07 | 0.11 | 0.18 | 0.07 | 0.08 | 0.12 | 0.05 | 0.06 | 0.06 | | | | | | |
| | SCB | **0.83** | **0.98** | **0.99** | | | | 0.07 | 0.08 | 0.13 | 0.15 | 0.26 | 0.48 | 0.05 | 0.05 | 0.06 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Largemouth bass** | BWCS | 0.11 | 0.20 | 0.35 | | | | 0.06 | 0.09 | 0.13 | 0.06 | 0.08 | 0.11 | | | | | | | | | | | | |
| | IMPS | **0.65** | **0.92** | **0.99** | | | | 0.06 | 0.08 | 0.10 | 0.06 | 0.07 | 0.10 | | | | | | | | | | | | |
| | SCB | 0.11 | 0.17 | 0.31 | | | | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.09 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Northern pike** | IMPS | <0.01 | <0.01 | <0.01 | | | | 0.05 | 0.05 | 0.06 | <0.01 | <0.01 | <0.01 | 0.05 | 0.05 | 0.06 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Sauger** | MCBU | 0.14 | 0.23 | 0.42 | | | | | | | 0.06 | 0.08 | 0.11 | | | | | | | | | | | | |
| | SCB | 0.13 | 0.21 | 0.38 | | | | 0.06 | 0.08 | 0.11 | 0.06 | 0.07 | 0.09 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | IMPS | 0.21 | 0.37 | **0.66** | | | | 0.06 | 0.07 | 0.10 | 0.07 | 0.10 | 0.17 | | | | | | | | | | | | |
| **Smallmouth buffalo** | MCBU | 0.41 | **0.68** | **0.94** | | | | | | | 0.06 | 0.07 | 0.09 | 0.49 | **0.79** | **0.98** | 0.13 | 0.22 | 0.41 | | | | | | |
| | SCB | 0.29 | **0.52** | **0.82** | | | | 0.05 | 0.05 | 0.06 | 0.05 | 0.06 | 0.06 | 0.24 | 0.47 | **0.78** | 0.08 | 0.12 | 0.20 | | | | | | |
| **Walleye** | MCBU | 0.05 | 0.05 | 0.06 | | | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **White bass** | MCBU | **0.77** | **0.97** | **0.99** | | | | | | | 0.08 | 0.12 | 0.19 | 0.08 | 0.10 | 0.16 | 0.08 | 0.10 | 0.17 | | | | | | |
| **White crappie** | BWCS | 0.12 | 0.22 | 0.39 | | | | 0.22 | 0.46 | **0.77** | 0.10 | 0.17 | 0.30 | | | | | | | | | | | | |
| | IMPS | 0.06 | 0.07 | 0.10 | | | | | | | 0.06 | 0.09 | 0.13 | | | | | | | | | | | | |
| Flathead catfish | MCBU | 0.27 | 0.48 | **0.79** | | | | | | | 0.05 | 0.05 | 0.06 | 0.17 | 0.29 | **0.52** | 0.10 | 0.15 | 0.27 | | | | | | |
| | MCBW | 0.22 | 0.49 | **0.83** | | | | | | | <0.01 | <0.01 | <0.01 | 0.05 | 0.07 | 0.10 | 0.05 | 0.06 | 0.06 | | | | | | |
| Orangespotted sunfish | BWCS | 0.38 | **0.70** | **0.94** | | | | 0.06 | 0.08 | 0.12 | 0.19 | 0.38 | **0.68** | | | | | | | | | | | | |
| | IMPS | 0.20 | 0.35 | **0.63** | | | | | | | 0.06 | 0.08 | 0.12 | | | | | | | | | | | | |
| Shortnose gar | BWCS | 0.17 | 0.32 | **0.56** | | | | 0.45 | **0.83** | **0.99** | 0.16 | 0.31 | **0.57** | | | | | | | | | | | | |
| | IMPS | 0.12 | 0.20 | 0.36 | | | | 0.11 | 0.22 | 0.40 | 0.07 | 0.11 | 0.18 | | | | | | | | | | | | |
| | SCB | 0.43 | **0.72** | **0.95** | | | | 0.08 | 0.12 | 0.21 | 0.08 | 0.12 | 0.19 | 0.05 | 0.05 | 0.06 | <0.01 | <0.01 | <0.01 | | | | | | |

[a]BWCS = Backwater contiguous lake shoreline, IMPS = Backwater contiguous shoreline, MCBU = Main channel border unstructured, SCB = Side channel border.

**Table C-5.** For the Open River trend analysis area, statistical power (at $\alpha = 0.05$) to detect a 20% annual change in mean catch-per-unit-effort at halved, present, and doubled levels of effort with eight standard sampling gears used in the Long Term Resource Monitoring Program (LTRMP). Fish were sampled from 1993 to 1999. Fish species listed include the 14 species (*in bold*) of special interest to LTRMP partners and other species for which power was at least 0.50 (*in bold*) for one or more gears at the doubled level of effort. Blank spaces indicate an aquatic area category not sampled by that gear or low power. (Shaded bars are added for readability.)

| | Aquatic area | Sampling gear and effort | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Day electrofishing | | | Seine | | | Fyke net | | | Mini fyke net | | | Large hoop net | | | Small hoop net | | | Tandem fyke net | | | Tandem mini fyke net | | |
| Fish species | category[a] | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled |
| **Black crappie** | MCBW | 0.06 | 0.06 | 0.08 | | | | <0.01 | 0.06 | 0.08 | 0.09 | 0.14 | 0.24 | 0.05 | 0.06 | 0.06 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.07 | 0.08 | 0.12 | <0.01 | <0.01 | <0.01 | 0.07 | 0.11 | 0.17 | 0.10 | 0.15 | 0.26 | 0.06 | 0.06 | 0.07 | 0.06 | 0.06 | 0.08 | | | | | | |
| **Bluegill** | SCB | 0.10 | 0.17 | 0.29 | <0.01 | <0.01 | <0.01 | 0.07 | 0.09 | 0.13 | 0.24 | 0.45 | **0.75** | 0.05 | 0.05 | 0.06 | 0.06 | 0.06 | 0.08 | | | | | | |
| **Channel catfish** | MCBU | 0.32 | **0.62** | **0.91** | <0.01 | 0.10 | 0.19 | | | | 0.18 | 0.32 | **0.58** | 0.09 | 0.18 | 0.30 | 0.25 | **0.50** | **0.80** | | | | | | |
| | SCB | 0.36 | **0.64** | **0.91** | 0.08 | 0.14 | 0.28 | 0.08 | 0.13 | 0.23 | 0.43 | **0.75** | **0.96** | 0.29 | **0.54** | **0.84** | **0.51** | **0.80** | **0.98** | | | | | | |
| **Common carp** | SCB | **0.78** | **0.98** | **0.99** | 0.05 | 0.05 | 0.06 | 0.12 | 0.22 | 0.41 | 0.14 | 0.24 | 0.44 | 0.42 | **0.73** | **0.96** | 0.43 | **0.71** | **0.95** | | | | | | |
| **Emerald shiner** | MCBU | 0.23 | 0.45 | **0.76** | <0.01 | 0.23 | **0.53** | | | | 0.13 | 0.22 | 0.40 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Freshwater drum** | MCBU | 0.17 | 0.33 | **0.60** | <0.01 | 0.06 | 0.08 | | | | 0.23 | 0.41 | **0.70** | 0.12 | 0.24 | **0.60** | 0.08 | 0.13 | 0.21 | | | | | | |
| | SCB | 0.29 | **0.53** | **0.82** | 0.06 | 0.08 | 0.13 | 0.18 | 0.36 | **0.64** | 0.34 | **0.62** | **0.90** | 0.23 | 0.43 | **0.73** | 0.10 | 0.15 | 0.26 | | | | | | |
| **Gizzard shad** | MCBU | **0.70** | **0.97** | **0.99** | <0.01 | **0.54** | **0.93** | | | | 0.16 | 0.28 | **0.51** | 0.07 | 0.10 | 0.14 | 0.06 | 0.06 | 0.08 | | | | | | |
| | SCB | **0.81** | **0.99** | **0.99** | 0.10 | 0.24 | **0.51** | 0.08 | 0.11 | 0.18 | 0.25 | 0.48 | **0.78** | 0.10 | 0.17 | 0.29 | 0.05 | 0.06 | 0.06 | | | | | | |
| **Largemouth bass** | MCBW | 0.06 | 0.08 | 0.11 | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.06 | 0.08 | 0.10 | <0.01 | <0.01 | <0.01 | 0.05 | 0.05 | 0.06 | 0.05 | 0.05 | 0.06 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Northern pike** | SCB | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Sauger** | MCBU | 0.07 | 0.11 | 0.17 | <0.01 | 0.05 | 0.06 | | | | 0.08 | 0.11 | 0.17 | <0.01 | <0.01 | <0.01 | 0.06 | 0.06 | 0.08 | | | | | | |
| | SCB | 0.08 | 0.12 | 0.19 | 0.05 | 0.06 | 0.07 | 0.06 | 0.07 | 0.08 | 0.08 | 0.11 | 0.18 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Smallmouth buffalo** | MCBU | 0.14 | 0.29 | **0.52** | <0.01 | <0.01 | <0.01 | | | | 0.05 | 0.05 | 0.06 | 0.14 | 0.29 | **0.52** | 0.07 | 0.09 | 0.14 | | | | | | |
| | SCB | 0.23 | 0.44 | **0.72** | 0.34 | **0.89** | **0.99** | 0.06 | 0.08 | 0.11 | 0.06 | 0.07 | 0.10 | 0.35 | **0.64** | **0.91** | 0.08 | 0.12 | 0.20 | | | | | | |
| **Walleye** | MCBU | 0.05 | 0.06 | 0.07 | <0.01 | <0.01 | <0.01 | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **White bass** | MCBU | 0.33 | **0.63** | **0.92** | <0.01 | 0.06 | 0.10 | | | | 0.13 | 0.22 | 0.40 | 0.06 | 0.08 | 0.12 | 0.07 | 0.10 | 0.16 | | | | | | |
| | SCB | **0.52** | **0.84** | **0.99** | 0.06 | 0.07 | 0.11 | 0.10 | 0.18 | 0.32 | 0.15 | 0.26 | 0.47 | 0.08 | 0.11 | 0.17 | 0.08 | 0.12 | 0.19 | | | | | | |
| **White crappie** | SCB | 0.06 | 0.08 | 0.10 | <0.01 | <0.01 | <0.01 | 0.07 | 0.10 | 0.16 | 0.13 | 0.22 | 0.40 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Channel shiner | MCBW | 0.05 | 0.06 | 0.06 | | | | <0.01 | <0.01 | <0.01 | 0.26 | **0.50** | **0.83** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.09 | 0.13 | 0.22 | 0.05 | 0.07 | 0.09 | <0.01 | <0.01 | <0.01 | 0.20 | 0.37 | **0.65** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Flathead catfish** | MCBW | 0.24 | **0.50** | **0.81** | | | | <0.01 | 0.30 | **0.56** | 0.06 | 0.08 | 0.11 | 0.09 | 0.14 | 0.14 | 0.07 | 0.12 | 0.20 | | | | | | |
| | SCB | 0.18 | 0.33 | **0.58** | 0.05 | 0.05 | 0.06 | 0.10 | 0.17 | 0.30 | 0.09 | 0.14 | 0.24 | 0.16 | 0.29 | **0.52** | 0.21 | 0.37 | **0.64** | | | | | | |
| Goldeye | MCBU | 0.37 | **0.69** | **0.95** | <0.01 | 0.08 | 0.14 | | | | 0.08 | 0.10 | 0.17 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.24 | 0.44 | **0.72** | <0.01 | <0.01 | <0.01 | 0.06 | 0.06 | 0.08 | 0.10 | 0.16 | 0.28 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Red shiner | MCBW | 0.09 | 0.15 | 0.26 | | | | <0.01 | <0.01 | <0.01 | 0.16 | 0.30 | **0.57** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.35 | **0.63** | **0.90** | 0.06 | 0.09 | 0.16 | <0.01 | <0.01 | <0.01 | 0.14 | 0.25 | 0.44 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| River carpsucker | SCB | 0.28 | **0.52** | **0.81** | 0.08 | 0.14 | 0.28 | 0.08 | 0.12 | 0.19 | 0.08 | 0.12 | 0.20 | 0.15 | 0.26 | 0.47 | 0.07 | 0.09 | 0.13 | | | | | | |
| River shiner | MCBU | 0.06 | 0.08 | 0.11 | <0.01 | <0.01 | <0.01 | | | | 0.07 | 0.08 | 0.12 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Shortnose gar | SCB | 0.26 | 0.49 | **0.78** | 0.05 | 0.06 | 0.07 | 0.13 | 0.24 | 0.45 | 0.10 | 0.16 | 0.30 | 0.06 | 0.11 | 0.18 | 0.08 | 0.11 | 0.18 | | | | | | |

[a]MCBW = Main channel border wing dam, MCBU = Main channel border unstructured, SCB = Side channel border.

**Table C-6.** For La Grange Pool, Illinois River, statistical power (at $\alpha = 0.05$) to detect a 20% annual change in mean catch-per-unit-effort at halved, present, and doubled levels of effort with eight standard sampling gears used in the Long Term Resource Monitoring Program (LTRMP). Fish were sampled from 1993 to 1999. Fish species listed include the 14 species (*in bold*) of special interest to LTRMP partners and other species for which power was at least 0.50 (*in bold*) for one or more gears at the doubled level of effort. Blank spaces indicate an aquatic area category not sampled by that gear or low power. (Shaded bars are added for readability.)

| | Aquatic area | Sampling gear and effort | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Day electrofishing | | | Seine | | | Fyke net | | | Mini fyke net | | | Large hoop net | | | Small hoop net | | | Tandem fyke net | | | Tandem mini fyke net | | |
| Fish species | category[a] | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled | Halved | Present | Doubled |
| **Black crappie** | BWCO | | | | | | | | | | | | | 0.09 | 0.14 | 0.24 | 0.08 | 0.12 | 0.19 | 0.39 | **0.70** | **0.95** | 0.12 | 0.20 | 0.36 |
| | BWCS | **0.64** | **0.92** | **0.99** | 0.06 | 0.07 | 0.09 | **0.87** | **0.99** | **0.99** | 0.24 | 0.44 | **0.73** | | | | | | | | | | | | |
| **Bluegill** | BWCS | **0.89** | **0.99** | **0.99** | 0.06 | 0.07 | 0.10 | **0.74** | **0.96** | **0.99** | 0.47 | **0.78** | **0.97** | | | | | | | | | | | | |
| **Channel catfish** | MCBU | 0.34 | **0.60** | **0.89** | 0.06 | 0.07 | 0.10 | | | | 0.20 | 0.36 | **0.62** | 0.24 | 0.45 | **0.74** | **0.57** | **0.88** | **0.99** | | | | | | |
| | SCB | **0.64** | **0.92** | **0.99** | 0.06 | 0.07 | 0.10 | | | | 0.20 | 0.37 | **0.65** | 0.20 | 0.36 | **0.65** | 0.26 | **0.50** | **0.81** | | | | | | |
| **Common carp** | SCB | **0.99** | **0.99** | **0.99** | <0.01 | <0.01 | <0.01 | | | | 0.13 | 0.22 | 0.41 | **0.83** | **0.99** | **0.99** | **0.59** | **0.90** | **0.99** | | | | | | |
| **Emerald shiner** | MCBU | 0.39 | **0.67** | **0.93** | 0.45 | **0.82** | **0.99** | | | | 0.33 | **0.59** | **0.87** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Freshwater drum** | BWCS | **0.66** | **0.93** | **0.99** | <0.01 | <0.01 | <0.01 | **0.61** | **0.90** | **0.99** | 0.33 | **0.60** | **0.88** | | | | | | | | | | | | |
| | SCB | **0.75** | **0.97** | **0.99** | 0.06 | 0.07 | 0.10 | | | | 0.38 | **0.67** | **0.93** | 0.15 | 0.27 | **0.51** | 0.11 | 0.18 | 0.33 | | | | | | |
| **Gizzard shad** | BWCS | **0.99** | **0.99** | **0.99** | 0.23 | **0.52** | **0.85** | **0.59** | **0.89** | **0.99** | 0.32 | **0.58** | **0.86** | | | | | | | | | | | | |
| | MCBU | **0.85** | **0.99** | **0.99** | 0.32 | **0.65** | **0.93** | | | | 0.23 | 0.43 | **0.71** | 0.11 | 0.18 | 0.33 | 0.05 | 0.06 | 0.07 | | | | | | |
| | SCB | **0.99** | **0.99** | **0.99** | 0.40 | **0.94** | **0.99** | | | | 0.28 | **0.52** | **0.82** | 0.10 | 0.15 | 0.28 | 0.05 | 0.05 | 0.06 | | | | | | |
| **Largemouth bass** | BWCS | **0.96** | **0.99** | **0.99** | 0.11 | 0.22 | 0.42 | 0.15 | 0.26 | 0.46 | 0.12 | 0.20 | 0.36 | | | | | | | | | | | | |
| | SCB | 0.46 | **0.77** | **0.97** | 0.06 | 0.10 | 0.18 | | | | 0.12 | 0.20 | 0.36 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **Northern pike** | BWCO | | | | | | | | | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.05 | 0.06 | 0.07 | <0.01 | <0.01 | <0.01 |
| | BWCS | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.05 | 0.05 | 0.06 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | |
| **Sauger** | MCBU | 0.49 | **0.80** | **0.98** | 0.07 | 0.10 | 0.16 | | | | 0.18 | 0.32 | **0.55** | 0.06 | 0.06 | 0.07 | 0.06 | 0.06 | 0.07 | | | | | | |
| | SCB | 0.35 | **0.62** | **0.89** | 0.07 | 0.11 | 0.19 | | | | 0.12 | 0.19 | 0.34 | 0.06 | 0.06 | 0.07 | 0.05 | 0.06 | 0.07 | | | | | | |
| **Smallmouth buffalo** | MCBU | **0.72** | **0.95** | **0.99** | 0.12 | 0.23 | 0.44 | | | | 0.10 | 0.16 | 0.27 | **0.60** | **0.90** | **0.99** | 0.09 | 0.14 | 0.24 | | | | | | |
| | SCB | **0.87** | **0.99** | **0.99** | 0.06 | 0.07 | 0.10 | | | | 0.08 | 0.12 | 0.19 | 0.37 | **0.66** | **0.93** | 0.08 | 0.11 | 0.19 | | | | | | |
| **Walleye** | MCBU | 0.05 | 0.06 | 0.06 | <0.01 | <0.01 | <0.01 | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| | SCB | 0.06 | 0.07 | 0.09 | <0.01 | <0.01 | <0.01 | | | | 0.05 | 0.06 | 0.07 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| **White bass** | MCBU | **0.95** | **0.99** | **0.99** | 0.34 | **0.67** | **0.94** | | | | **0.62** | **0.91** | **0.99** | 0.08 | 0.11 | 0.17 | 0.09 | 0.14 | 0.23 | | | | | | |
| **White crappie** | BWCO | | | | | | | | | | | | | 0.09 | 0.14 | 0.24 | 0.11 | 0.17 | 0.31 | **0.52** | **0.84** | **0.99** | 0.16 | 0.30 | **0.55** |
| | BWCS | 0.41 | **0.71** | **0.95** | 0.06 | 0.07 | 0.10 | **0.59** | **0.89** | **0.99** | 0.22 | 0.41 | **0.69** | | | | | | | | | | | | |
| Bigmouth buffalo | BWCS | **0.53** | **0.83** | **0.99** | 0.06 | 0.07 | 0.10 | 0.11 | 0.17 | 0.30 | 0.06 | 0.08 | 0.11 | | | | | | | | | | | | |
| | SCB | 0.38 | **0.66** | **0.92** | <0.01 | <0.01 | <0.01 | | | | <0.01 | <0.01 | <0.01 | 0.05 | 0.05 | 0.06 | <0.01 | <0.01 | <0.01 | | | | | | |
| Black buffalo | BWCS | 0.20 | 0.37 | **0.63** | <0.01 | <0.01 | <0.01 | 0.07 | 0.09 | 0.13 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | |
| Brown bullhead | BWCS | 0.08 | 0.12 | 0.19 | <0.01 | <0.01 | <0.01 | 0.19 | 0.33 | **0.58** | 0.08 | 0.10 | 0.16 | | | | | | | | | | | | |
| Flathead catfish | SCB | 0.19 | 0.33 | **0.58** | <0.01 | <0.01 | <0.01 | | | | 0.06 | 0.07 | 0.10 | 0.09 | 0.14 | 0.25 | 0.07 | 0.09 | 0.13 | | | | | | |
| River carpsucker | BWCS | 0.26 | 0.47 | **0.77** | 0.09 | 0.15 | 0.28 | 0.37 | **0.66** | **0.92** | 0.07 | 0.10 | 0.14 | | | | | | | | | | | | |
| | SCB | 0.21 | 0.37 | **0.64** | 0.09 | 0.19 | 0.40 | | | | 0.07 | 0.09 | 0.14 | 0.09 | 0.15 | 0.26 | 0.05 | 0.06 | 0.06 | | | | | | |
| Shortnose gar | BWCS | 0.13 | 0.22 | 0.38 | <0.01 | <0.01 | <0.01 | 0.40 | **0.69** | **0.94** | 0.15 | 0.26 | 0.46 | | | | | | | | | | | | |
| Skipjack herring | MCBU | 0.30 | **0.55** | **0.84** | 0.06 | 0.07 | 0.10 | | | | 0.06 | 0.07 | 0.10 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Silver chub | SCB | 0.08 | 0.10 | 0.16 | 0.16 | 0.47 | **0.84** | | | | 0.08 | 0.10 | 0.16 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Spottail shiner | MCBU | 0.05 | 0.06 | 0.06 | 0.29 | **0.60** | **0.90** | | | | 0.07 | 0.10 | 0.15 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Threadfin shad | MCBU | 0.23 | 0.42 | **0.71** | 0.09 | 0.15 | 0.26 | | | | 0.09 | 0.13 | 0.22 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Yellow bullhead | BWCS | 0.11 | 0.17 | 0.29 | <0.01 | <0.01 | <0.01 | 0.19 | 0.34 | **0.60** | 0.12 | 0.19 | 0.33 | | | | | | | | | | | | |

[a]BWCO = Backwater contiguous lake offshore, BWCS = Backwater contiguous lake shoreline, MCBU = Main channel border unstructured, SCB = Side channel border.

## Appendix D. Catch by Gear Type for Fish of All Sizes

Appendix D contains six tables, one for each trend analysis area, listing mean annual catch and variance of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program and the percentage of total annual catch accounted for by that species within each gear and across all gears. Fish of all sizes were included in these analyses. Information on how each gear is fished and what constitutes an independent sample can be found in Gutreuter et al. (1995.)

**Table D-1.** For Navigation Pool 4, mean annual catch for fish of all sizes and variance (*in parentheses*) of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program (LTRMP) and the percentage of total annual catch accounted for by that species within a gear (a column) and across all gears (a row). "*N*" is the mean number of independent samples collected annually with one standard error (*in parentheses*). Species are listed in order of abundance in total annual catch for all gears combined. Only species comprising the top 99% of the total catch within Navigation Pool 4 are included, except that species of particular management interest that did not contribute to the top 99% are also included. Data were from stratified random sampling during 1993 through 1999 in the LTRMP Fish Component. (Shaded bars are added for readability.)

| | Day electrofishing *N* = 81.3 (1.8) | | | Night electrofishing *N* = 11.7 (0.2) | | | Bottom trawling *N* = 4.0 (0.8) | | | Seining *N* = 30.4 (2.2) | | | Mini fyke nets *N* = 61.1 (2.5) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean annual catch | Percentage of annual catch | | Mean annual catch | Percentage of annual catch | | Mean annual catch | Percentage of annual catch | | Mean annual catch | Percentage of annual catch | | Mean annual catch | Percentage of annual catch | |
| Species | (variance) | This gear | All gears | (variance) | This gear | All gears | (variance) | This gear | All gears | (variance) | This gear | All gears | (variance) | This gear | All gears |
| Emerald shiner | 4030 (1088) | 46 | 8 | 4951 (2518) | 65 | 10 | <1 (<1) | <1 | <1 | 8713 (2904) | 72 | 17 | 34116 (18016) | 94 | 66 |
| Gizzard shad | 1078 (100) | 12 | 38 | 1368 (595) | 18 | 49 | 8 (8) | 13 | <1 | 117 (49) | 1 | 4 | 94 (35) | <1 | 3 |
| Spotfin shiner | 218 (59) | 2 | 12 | 6 (2) | <1 | <1 | <1 (<1) | <1 | <1 | 1396 (335) | 12 | 76 | 212 (70) | 1 | 12 |
| Bluegill | 489 (70) | 6 | 27 | 164 (47) | 2 | 9 | <1 (<1) | <1 | <1 | 101 (45) | 1 | 6 | 495 (131) | 1 | 27 |
| Common carp | 499 (31) | 6 | 43 | 133 (19) | 2 | 11 | <1 (<1) | <1 | <1 | 4 (2) | <1 | <1 | 54 (28) | <1 | 5 |
| White bass | 225 (47) | 3 | 21 | 231 (68) | 3 | 22 | <1 (<1) | <1 | <1 | 104 (46) | 1 | 10 | 234 (138) | 1 | 22 |
| Mimic shiner | 29 (11) | <1 | 3 | 3 (1) | <1 | <1 | <1 (<1) | <1 | <1 | 517 (210) | 4 | 54 | 388 (122) | 1 | 41 |
| Black crappie | 62 (14) | 1 | 7 | 29 (5) | <1 | 3 | <1 (<1) | <1 | <1 | 9 (2) | <1 | 1 | 41 (8) | <1 | 5 |
| Freshwater drum | 124 (6) | 1 | 15 | 103 (20) | 1 | 13 | 17 (7) | 28 | 2 | 10 (3) | <1 | 1 | 37 (7) | <1 | 5 |
| Bullhead minnow | 56 (26) | 1 | 8 | 3 (1) | <1 | <1 | <1 (<1) | <1 | <1 | 404 (137) | 3 | 61 | 163 (74) | <1 | 25 |
| Sauger | 106 (16) | 1 | 24 | 299 (44) | 4 | 67 | 3 (2) | 5 | 1 | 9 (3) | <1 | 2 | 5 (2) | <1 | 1 |
| Shorthead redhorse | 265 (29) | 3 | 73 | 26 (6) | <1 | 7 | 1 (1) | 2 | <1 | 6 (2) | <1 | 2 | 3 (1) | <1 | 1 |
| Largemouth bass | 207 (27) | 2 | 65 | 26 (4) | <1 | 8 | <1 (<1) | <1 | <1 | 22 (6) | <1 | 7 | 57 (36) | <1 | 18 |
| Smallmouth bass | 215 (26) | 2 | 69 | 65 (9) | 1 | 21 | <1 (<1) | <1 | <1 | 27 (6) | <1 | 9 | 3 (1) | <1 | 1 |
| Silver redhorse | 123 (8) | 1 | 41 | 4 (2) | <1 | 1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 10 (3) | <1 | 3 |
| Yellow perch | 159 (40) | 2 | 57 | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 19 (10) | <1 | 7 | 12 (5) | <1 | 4 |
| River shiner | 99 (32) | 1 | 38 | 2 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 150 (36) | 1 | 57 | 11 (4) | <1 | 4 |
| Logperch | 95 (32) | 1 | 45 | 13 (3) | <1 | 6 | <1 (<1) | <1 | <1 | 41 (9) | <1 | 19 | 49 (20) | <1 | 23 |
| Walleye | 74 (10) | 1 | 36 | 109 (19) | 1 | 53 | <1 (<1) | <1 | <1 | 5 (2) | <1 | 2 | 2 (1) | <1 | 1 |
| Rock bass | 67 (7) | 1 | 35 | 5 (2) | <1 | 2 | <1 (<1) | <1 | <1 | 11 (3) | <1 | 6 | 16 (5) | <1 | 8 |
| Spottail shiner | 58 (17) | 1 | 31 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 56 (24) | <1 | 30 | 33 (13) | <1 | 17 |
| Channel catfish | 17 (3) | <1 | 9 | 5 (1) | <1 | 3 | 16 (5) | 27 | 8 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 1 |
| Smallmouth buffalo | 24 (3) | <1 | 13 | 8 (2) | <1 | 4 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Johnny darter | 10 (1) | <1 | 7 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 85 (15) | 1 | 58 | 23 (11) | <1 | 16 |
| Quillback | 46 (9) | 1 | 37 | 2 (1) | <1 | 2 | <1 (<1) | <1 | <1 | 70 (31) | 1 | 57 | 2 (1) | <1 | 1 |
| Pugnose minnow | 12 (3) | <1 | 12 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 3 (3) | <1 | 3 | 51 (14) | <1 | 50 |
| Speckled chub | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 6 (4) | 10 | 6 | 34 (32) | <1 | 37 | 51 (18) | <1 | 56 |
| Bowfin | 21 (3) | <1 | 26 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (1) | <1 | 8 |
| River darter | 4 (1) | <1 | 4 | 1 (<1) | <1 | 1 | <1 (<1) | 1 | 1 | 19 (5) | <1 | 24 | 53 (39) | <1 | 65 |
| Northern pike | 26 (3) | <1 | 33 | 5 (2) | <1 | 7 | <1 (<1) | <1 | <1 | 9 (5) | <1 | 12 | 7 (2) | <1 | 9 |
| Spotted sucker | 63 (9) | 1 | 82 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 1 |
| White crappie | 9 (2) | <1 | 13 | 12 (2) | <1 | 16 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | 8 (2) | <1 | 11 |
| Flathead catfish | 12 (3) | <1 | 24 | 12 (2) | <1 | 23 | 1 (1) | 2 | 2 | <1 (<1) | <1 | <1 | 3 (1) | <1 | 7 |
| Bigmouth buffalo | 9 (2) | <1 | 54 | 3 (2) | <1 | 18 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 5 | 1 (1) | <1 | 8 |
| Shovelnose sturgeon | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 6 (2) | 10 | 87 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Blue sucker | 2 (<1) | <1 | 80 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 7 | <1 (<1) | <1 | <1 |
| Lake sturgeon | <1 (<1) | <1 | 14 | <1 (<1) | <1 | <1 | 1 (<1) | 2 | 71 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Skipjack herring | <1 (<1) | <1 | 50 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 50 |
| Goldeye | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 100 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Paddlefish | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 100 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Bighead carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Blue catfish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Grass carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| All species | 8723 (1247) | 100 | 13 | 7623 (2444) | 100 | 11 | 60 (23) | 100 | <1 | 12071 (3233) | 100 | 18 | 36299 (17904) | 100 | 53 |

| | Fyke nets *N* = 32.3 (1.9) | | | Large hoop nets *N* = 55.4 (3.1) | | | Small hoop nets *N* = 55.4 (3.3) | | | Tandem fyke nets *N* = 26.4 (1.3) | | | Tandem mini fyke nets *N* = 26.6 (1.2) | | | All gears combined *N* = 384.7 (8.6) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean annual catch | Percentage of annual catch | | Mean annual catch | Percentage of annual catch | | Mean annual catch | Percentage of annual catch | | Mean annual catch | Percentage of annual catch | | Mean annual catch | Percentage of annual catch | | Mean annual catch | Percentage of this species in total annual catch |
| Species | (variance) | This gear | All gears | (variance) | This gear | All gears | (variance) | This gear | All gears | (variance) | This gear | All gears | (variance) | This gear | All gears | (variance) | |
| Emerald shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 173 (85) | 24 | <1 | 51984 (18989) | 75 |
| Gizzard shad | 43 (17) | 4 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 67 (24) | 4 | 2 | 43 (11) | 6 | 2 | 2818 (700) | 4 |
| Spotfin shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 9 (5) | 1 | 1 | 1841 (383) | 3 |
| Bluegill | 170 (48) | 17 | 9 | 3 (1) | 1 | <1 | 12 (4) | 5 | 1 | 276 (110) | 17 | 15 | 102 (42) | 14 | 6 | 1811 (368) | 3 |
| Common carp | 61 (10) | 6 | 5 | 214 (33) | 42 | 18 | 95 (21) | 38 | 8 | 95 (18) | 6 | 8 | 14 (5) | 2 | 1 | 1169 (63) | 2 |
| White bass | 106 (29) | 10 | 10 | 12 (6) | 2 | 1 | 3 (2) | 1 | <1 | 125 (39) | 8 | 12 | 26 (12) | 4 | 2 | 1067 (349) | 2 |
| Mimic shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 12 (8) | 2 | 1 | 949 (226) | 1 |
| Black crappie | 241 (47) | 23 | 27 | 26 (12) | 5 | 3 | 6 (1) | 2 | 1 | 441 (42) | 27 | 49 | 44 (12) | 6 | 5 | 898 (92) | 1 |
| Freshwater drum | 177 (41) | 17 | 22 | 46 (4) | 9 | 6 | 17 (5) | 7 | 2 | 225 (58) | 14 | 28 | 56 (9) | 8 | 7 | 812 (96) | 1 |
| Bullhead minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 35 (16) | 5 | 5 | 661 (193) | <1 |
| Sauger | 6 (2) | 1 | 1 | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 12 (2) | 1 | 3 | 4 (1) | 1 | 1 | 445 (65) | <1 |
| Shorthead redhorse | 19 (3) | 2 | 5 | 9 (1) | 2 | 2 | 9 (3) | 4 | 2 | 21 (5) | 1 | 6 | 2 (1) | <1 | 1 | 362 (34) | <1 |
| Largemouth bass | 2 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 1 (1) | <1 | <1 | 318 (55) | <1 |
| Smallmouth bass | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 2 (1) | <1 | 1 | 313 (35) | <1 |
| Silver redhorse | 65 (13) | 6 | 22 | 10 (2) | 2 | 3 | 2 (1) | 1 | 1 | 86 (12) | 5 | 27 | 4 (1) | 1 | 1 | 298 (24) | <1 |
| Yellow perch | 16 (3) | 2 | 6 | <1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 68 (21) | 4 | 24 | 3 (1) | <1 | 1 | 279 (59) | <1 |
| River shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 261 (61) | <1 |
| Logperch | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 16 (10) | 2 | 7 | 214 (52) | <1 |
| Walleye | 3 (1) | <1 | 2 | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 9 (1) | 1 | 4 | 1 (1) | <1 | 1 | 205 (26) | <1 |
| Rock bass | 28 (8) | 3 | 15 | 1 (<1) | <1 | <1 | 10 (4) | 4 | 5 | 46 (7) | 3 | 24 | 10 (2) | 1 | 5 | 192 (25) | <1 |
| Spottail shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 42 (11) | 6 | 22 | 189 (43) | <1 |
| Channel catfish | 5 (1) | <1 | 3 | 61 (9) | 12 | 33 | 75 (17) | 31 | 41 | 2 (1) | <1 | 1 | 2 (1) | <1 | 1 | 185 (27) | <1 |
| Smallmouth buffalo | 6 (1) | 1 | 3 | 106 (14) | 21 | 58 | 7 (2) | 3 | 4 | 30 (22) | 2 | 17 | 1 (<1) | <1 | <1 | 182 (21) | <1 |
| Johnny darter | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 29 (17) | 4 | 20 | 147 (39) | <1 |
| Quillback | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 2 | <1 (<1) | <1 | <1 | 123 (36) | <1 |
| Pugnose minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 35 (13) | 5 | 35 | 101 (25) | <1 |
| Speckled chub | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 91 (29) | <1 |
| Bowfin | 19 (2) | 2 | 23 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | 1 | 32 (10) | 2 | 39 | 2 (<1) | <1 | 2 | 82 (14) | <1 |
| River darter | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 4 (2) | 1 | 5 | 81 (44) | <1 |
| Northern pike | 13 (2) | 1 | 17 | 2 (1) | <1 | 3 | <1 (<1) | <1 | <1 | 12 (2) | 1 | 15 | 4 (2) | 1 | 5 | 79 (8) | <1 |
| Spotted sucker | 7 (1) | 1 | 9 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 6 (2) | <1 | 8 | <1 (<1) | <1 | <1 | 77 (11) | <1 |
| White crappie | 7 (2) | 1 | 10 | 1 (<1) | <1 | 1 | 1 (<1) | <1 | 1 | 17 (5) | 1 | 23 | 16 (8) | 2 | 23 | 71 (9) | <1 |
| Flathead catfish | 4 (1) | <1 | 8 | 13 (2) | 2 | 26 | 3 (1) | 1 | 5 | 1 (1) | <1 | 3 | 1 (1) | <1 | 2 | 50 (7) | <1 |
| Bigmouth buffalo | <1 (<1) | <1 | 1 | <1 (<1) | <1 | 2 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 10 | <1 (<1) | <1 | 3 | 17 (4) | <1 |
| Shovelnose sturgeon | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 13 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (2) | <1 |
| Blue sucker | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 13 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (1) | <1 |
| Lake sturgeon | <1 (<1) | <1 | 14 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 |
| Skipjack herring | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Goldeye | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Paddlefish | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Bighead carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Blue catfish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Grass carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| All species | 1029 (142) | 100 | 1 | 513 (38) | 100 | 1 | 246 (26) | 100 | <1 | 1611 (170) | 100 | 2 | 723 (114) | 100 | 1 | 68897 (19214) | 100 |

**Table D-2.** For Navigation Pool 8, mean annual catch for fish of all sizes and variance (*in parentheses*) of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program (LTRMP) and the percentage of total annual catch accounted for by that species within a gear (a column) and across all gears (a row). "*N*" is the mean number of independent samples collected annually with one standard error (*in parentheses*). Species are listed in order of abundance in total annual catch for all gears combined. Only species comprising the top 99% of the total catch within Navigation Pool 8 are included, except that species of particular management interest that did not contribute to the top 99% are also included. Data were from stratified random sampling during 1993 through 1999 in the LTRMP Fish Component. (Shaded bars are added for readability.)

| | Day electrofishing *N* = 96.7 (2.3) | | | Night electrofishing *N* = 54.0 (0.0) | | | Bottom trawling *N* = 5.6 (1.7) | | | Seining *N* = 52.6 (10.6) | | | Mini fyke nets *N* = 83.0 (0.7) | | | Fyke nets *N* = 58.9 (1.1) | | | Large hoop nets *N* = 65.9 (0.1) | | | Small hoop nets *N* = 65.7 (0.2) | | | Tandem fyke nets *N* = 15.4 (1.2) | | | Tandem mini fyke nets *N* = 15.4 (1.2) | | | All gears combined *N* = 513.1 (8.3) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | Percentage of this species in total annual catch |
| Emerald shiner | 1753 (647) | 15 | 23 | 1444 (341) | 12 | 19 | <1 (<1) | <1 | <1 | 3399 (750) | 25 | 45 | 893 (346) | 11 | 12 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1 | <1 | <1 | <1 (<1) | <1 | <1 | 66 (26) | 5 | 1 | 7555 (1675) | 14 |
| Bluegill | 1779 (376) | 15 | 24 | 768 (178) | 7 | 10 | <1 (<1) | <1 | <1 | 751 (140) | 6 | 10 | 1451 (302) | 17 | 20 | 1658 (291) | 38 | 23 | 61 (26) | 8 | 1 | 28 (12) | 5 | <1 | 467 (116) | 30 | 6 | 379 (139) | 28 | 5 | 7342 (1147) | 14 |
| Spotfin shiner | 1349 (169) | 11 | 19 | 591 (132) | 5 | 8 | <1 (<1) | <1 | <1 | 3282 (438) | 25 | 46 | 1856 (461) | 22 | 26 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 18 (10) | 1 | <1 | 7097 (996) | 13 |
| Bullhead minnow | 669 (187) | 6 | 22 | 339 (116) | 3 | 11 | <1 (<1) | <1 | <1 | 931 (329) | 7 | 31 | 981 (526) | 12 | 32 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 104 (53) | 8 | 3 | 3023 (775) | 6 |
| Mimic shiner | 423 (245) | 4 | 14 | 673 (185) | 6 | 22 | <1 (<1) | <1 | <1 | 1456 (648) | 11 | 49 | 326 (132) | 4 | 11 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 113 (110) | 8 | 4 | 2990 (1035) | 6 |
| River shiner | 363 (39) | 3 | 14 | 551 (132) | 5 | 21 | <1 (<1) | <1 | <1 | 1229 (208) | 9 | 48 | 418 (137) | 5 | 16 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (2) | <1 | <1 | 2563 (315) | 5 |
| White bass | 162 (56) | 1 | 7 | 1353 (342) | 12 | 57 | <1 (<1) | <1 | <1 | 159 (109) | 1 | 7 | 107 (31) | 1 | 4 | 457 (244) | 10 | 19 | 10 (2) | 1 | <1 | 3 (1) | <1 | <1 | 103 (32) | 7 | 4 | 31 (18) | 2 | 1 | 2384 (729) | 4 |
| Gizzard shad | 991 (273) | 8 | 45 | 577 (186) | 5 | 26 | 1 (<1) | 1 | <1 | 331 (134) | 2 | 15 | 119 (67) | 1 | 5 | 90 (45) | 2 | 4 | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 76 (41) | 5 | 3 | 18 (10) | 1 | 1 | 2203 (636) | 4 |
| Black crappie | 120 (15) | 1 | 6 | 98 (11) | 1 | 5 | <1 (<1) | <1 | <1 | 31 (8) | <1 | 2 | 93 (21) | 1 | 5 | 1118 (90) | 26 | 56 | 90 (26) | 12 | 4 | 14 (4) | 3 | 1 | 386 (104) | 25 | 19 | 46 (13) | 3 | 2 | 1996 (168) | 4 |
| Shorthead redhorse | 516 (58) | 4 | 33 | 770 (66) | 7 | 50 | 4 (1) | 5 | <1 | 18 (8) | <1 | 1 | 22 (6) | <1 | 1 | 51 (9) | 1 | 3 | 57 (10) | 8 | 4 | 43 (10) | 8 | 3 | 58 (20) | 4 | 4 | 3 (<1) | <1 | <1 | 1542 (120) | 3 |
| Freshwater drum | 162 (73) | 1 | 12 | 589 (155) | 5 | 42 | 47 (15) | 58 | 3 | 103 (95) | 1 | 7 | 103 (66) | 1 | 7 | 111 (31) | 3 | 8 | 58 (8) | 8 | 4 | 41 (13) | 8 | 3 | 92 (13) | 6 | 7 | 88 (67) | 6 | 6 | 1394 (477) | 3 |
| Sauger | 118 (20) | 1 | 9 | 1145 (158) | 10 | 86 | 4 (2) | 5 | <1 | 6 (2) | <1 | <1 | 11 (5) | <1 | 1 | 29 (6) | 1 | 2 | <1 (<1) | <1 | <1 | 2 (1) | <1 | <1 | 16 (6) | 1 | 1 | 7 (6) | <1 | 1 | 1338 (182) | 2 |
| Common carp | 569 (54) | 5 | 44 | 224 (21) | 2 | 17 | 1 (<1) | 1 | <1 | 41 (35) | <1 | 3 | 195 (80) | 2 | 15 | 85 (8) | 2 | 7 | 66 (18) | 9 | 5 | 20 (4) | 4 | 2 | 33 (7) | 2 | 3 | 61 (49) | 4 | 5 | 1294 (162) | 2 |
| Pugnose minnow | 43 (10) | <1 | 3 | 18 (4) | <1 | 1 | <1 (<1) | <1 | <1 | 189 (38) | 1 | 15 | 706 (218) | 8 | 57 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 289 (126) | 21 | 23 | 1246 (336) | 2 |
| Largemouth bass | 570 (90) | 5 | 54 | 177 (58) | 2 | 17 | <1 (<1) | <1 | <1 | 90 (30) | 1 | 9 | 185 (141) | 2 | 18 | 19 (4) | <1 | 2 | 1 (1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (1) | <1 | <1 | 5 (2) | <1 | 1 | 1049 (226) | 2 |
| Smallmouth bass | 333 (47) | 3 | 39 | 486 (51) | 4 | 57 | <1 (<1) | <1 | <1 | 18 (4) | <1 | 2 | 10 (2) | <1 | 1 | 1 (<1) | <1 | <1 | 3 (1) | <1 | <1 | 1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 854 (94) | 2 |
| Silver redhorse | 231 (28) | 2 | 33 | 232 (22) | 2 | 33 | 1 (<1) | 1 | <1 | 19 (5) | <1 | 3 | 16 (4) | <1 | 2 | 105 (13) | 2 | 15 | 36 (7) | 5 | 5 | 5 (1) | 1 | 1 | 55 (11) | 4 | 8 | 2 (1) | <1 | <1 | 703 (59) | 1 |
| Channel catfish | 25 (3) | <1 | 4 | 43 (9) | <1 | 7 | 14 (4) | 17 | 2 | <1 (<1) | <1 | <1 | 2 (1) | <1 | <1 | 11 (2) | <1 | 2 | 176 (36) | 23 | 29 | 335 (64) | 63 | 55 | 5 (1) | <1 | 1 | 2 (1) | <1 | <1 | 614 (79) | 1 |
| Yellow perch | 193 (65) | 2 | 36 | 72 (11) | 1 | 13 | <1 (<1) | <1 | <1 | 58 (20) | <1 | 11 | 16 (6) | <1 | 3 | 99 (29) | 2 | 18 | 1 (<1) | <1 | <1 | 9 (4) | 2 | 2 | 81 (25) | 5 | 15 | 13 (6) | 1 | 2 | 541 (133) | 1 |
| Logperch | 246 (76) | 2 | 47 | 86 (27) | 1 | 16 | <1 (<1) | <1 | <1 | 122 (70) | 1 | 23 | 55 (16) | 1 | 10 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 19 (13) | 1 | 4 | 526 (185) | 1 |
| Johnny darter | 141 (57) | 1 | 28 | 30 (9) | <1 | 6 | <1 (<1) | <1 | <1 | 193 (60) | 1 | 39 | 117 (30) | 1 | 24 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 15 (7) | 1 | 3 | 496 (144) | 1 |
| Walleye | 63 (15) | 1 | 13 | 386 (68) | 3 | 78 | <1 (<1) | <1 | <1 | 10 (3) | <1 | 2 | 4 (1) | <1 | 1 | 11 (2) | <1 | 2 | 2 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 8 (3) | 1 | 2 | 9 (8) | 1 | 2 | 495 (82) | 1 |
| Quillback | 73 (24) | 1 | 16 | 91 (20) | 1 | 20 | <1 (<1) | <1 | <1 | 240 (83) | 2 | 52 | 50 (20) | 1 | 11 | 2 (1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 459 (129) | 1 |
| Rock bass | 148 (16) | 1 | 37 | 145 (18) | 1 | 36 | <1 (<1) | <1 | <1 | 25 (7) | <1 | 6 | 20 (3) | <1 | 5 | 39 (12) | 1 | 10 | 1 (<1) | <1 | <1 | 6 (1) | 1 | 2 | 11 (5) | 1 | 3 | 4 (2) | <1 | 1 | 399 (41) | 1 |
| Spottail shiner | 81 (22) | 1 | 21 | 30 (7) | <1 | 8 | <1 (<1) | <1 | <1 | 113 (40) | 1 | 30 | 146 (53) | 2 | 38 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 13 (4) | 1 | 3 | 383 (105) | 1 |
| Orangespotted sunfish | 132 (56) | 1 | 35 | 77 (44) | 1 | 21 | <1 (<1) | <1 | <1 | 60 (29) | <1 | 16 | 67 (27) | 1 | 18 | 4 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 2 (1) | <1 | 1 | 30 (12) | 2 | 8 | 373 (126) | 1 |
| Brook silverside | 30 (7) | <1 | 9 | 65 (20) | 1 | 20 | <1 (<1) | <1 | <1 | 206 (67) | 2 | 64 | 21 (8) | <1 | 6 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 323 (85) | 1 |
| Golden redhorse | 147 (24) | 1 | 46 | 153 (14) | 1 | 48 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (1) | <1 | 2 | 3 (1) | <1 | 1 | 2 (1) | <1 | 1 | 4 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 316 (37) | 1 |
| Smallmouth buffalo | 38 (22) | <1 | 13 | 39 (17) | <1 | 13 | <1 (<1) | <1 | <1 | 21 (21) | <1 | 7 | 30 (25) | <1 | 10 | 10 (4) | <1 | 3 | 145 (52) | 19 | 49 | 6 (2) | 1 | 2 | 5 (1) | <1 | 2 | 3 (2) | <1 | 1 | 297 (64) | 1 |
| Shortnose gar | 9 (2) | <1 | 3 | 8 (2) | <1 | 3 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 27 (4) | <1 | 10 | 184 (18) | 4 | 67 | 4 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 37 (11) | 2 | 14 | 4 (1) | <1 | 1 | 274 (27) | 1 |
| Spotted sucker | 131 (20) | 1 | 58 | 34 (3) | <1 | 15 | <1 (<1) | <1 | <1 | 17 (14) | <1 | 8 | 4 (2) | <1 | 2 | 24 (5) | 1 | 11 | 2 (1) | <1 | 1 | 1 (<1) | <1 | <1 | 13 (3) | 1 | 6 | <1 (<1) | <1 | <1 | 228 (18) | <1 |
| Northern pike | 42 (7) | <1 | 29 | 28 (4) | <1 | 19 | <1 (<1) | <1 | <1 | 5 (1) | <1 | 4 | 7 (3) | <1 | 5 | 37 (6) | 1 | 26 | 5 (1) | 1 | 4 | <1 (<1) | <1 | <1 | 20 (5) | 1 | 14 | 1 (<1) | <1 | <1 | 145 (15) | <1 |
| Golden shiner | 26 (6) | <1 | 19 | 3 (1) | <1 | 2 | <1 (<1) | <1 | <1 | 5 (1) | <1 | 4 | 87 (74) | 1 | 62 | 8 (3) | <1 | 6 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 8 (3) | 1 | 6 | 2 (1) | <1 | 1 | 140 (74) | <1 |
| Longnose gar | 19 (4) | <1 | 14 | 21 (4) | <1 | 15 | <1 (<1) | <1 | <1 | 3 (1) | <1 | 3 | 16 (4) | <1 | 12 | 56 (12) | 1 | 41 | 2 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 18 (4) | 1 | 13 | 1 (1) | <1 | 1 | 136 (14) | <1 |
| Green sunfish | 76 (21) | 1 | 59 | 20 (4) | <1 | 15 | <1 (<1) | <1 | <1 | 4 (3) | <1 | 3 | 26 (10) | <1 | 20 | 2 (1) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 129 (27) | <1 |
| Pumpkinseed | 39 (13) | <1 | 31 | 5 (1) | <1 | 4 | <1 (<1) | <1 | <1 | 5 (3) | <1 | 4 | 32 (10) | <1 | 25 | 35 (11) | 1 | 27 | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 6 (3) | <1 | 5 | 5 (2) | <1 | 4 | 128 (34) | <1 |
| Western sand darter | 2 (1) | <1 | 2 | 22 (7) | <1 | 20 | <1 (<1) | <1 | <1 | 85 (25) | 1 | 77 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 110 (26) | <1 |
| Bowfin | 20 (2) | <1 | 18 | 8 (2) | <1 | 8 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 1 | 2 (1) | <1 | 2 | 50 (9) | 1 | 46 | 4 (1) | <1 | 3 | 1 (1) | <1 | 1 | 23 (5) | 1 | 21 | 1 (<1) | <1 | 1 | 109 (14) | <1 |
| Weed shiner | 8 (4) | <1 | 8 | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 28 (17) | <1 | 28 | 62 (40) | 1 | 62 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 100 (62) | <1 |
| Flathead catfish | 12 (2) | <1 | 13 | 29 (4) | <1 | 32 | <1 (<1) | 1 | <1 | <1 (<1) | <1 | <1 | 6 (2) | <1 | 7 | 15 (2) | <1 | 16 | 20 (4) | 3 | 21 | 4 (1) | 1 | 4 | 4 (1) | <1 | 5 | 2 (2) | <1 | 2 | 93 (9) | <1 |
| River redhorse | 32 (3) | <1 | 39 | 49 (6) | <1 | 60 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 82 (7) | <1 |
| Mooneye | 6 (2) | <1 | 10 | 57 (13) | <1 | 84 | 1 (<1) | 1 | 1 | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 67 (15) | <1 |
| White crappie | 6 (2) | <1 | 10 | 3 (1) | <1 | 5 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 3 | 5 (2) | <1 | 8 | 22 (3) | 1 | 38 | 2 (1) | <1 | 4 | 2 (1) | <1 | 3 | 14 (4) | 1 | 24 | 3 (1) | <1 | 4 | 59 (6) | <1 |
| Bigmouth buffalo | 8 (3) | <1 | 50 | 5 (1) | <1 | 31 | <1 (<1) | <1 | 1 | 1 (<1) | <1 | 4 | 1 (1) | <1 | 8 | 1 (1) | <1 | 7 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 16 (4) | <1 |
| Blue sucker | 3 (1) | <1 | 39 | 3 (1) | <1 | 49 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 10 | <1 (<1) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (2) | <1 |
| Shovelnose sturgeon | <1 (<1) | <1 | 2 | <1 (<1) | <1 | 2 | 6 (3) | 7 | 91 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 5 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 6 (3) | <1 |
| Goldeye | <1 (<1) | <1 | 7 | 2 (2) | <1 | 87 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 7 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (2) | <1 |
| Lake sturgeon | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 100 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Skipjack herring | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 100 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Bighead carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Blue catfish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Grass carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Paddlefish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| All species | 11995 (1527) | 100 | 22 | 11646 (1355) | 100 | 22 | 81 (17) | 100 | <1 | 13387 (1902) | 100 | 25 | 8377 (1546) | 100 | 15 | 4353 (213) | 100 | 8 | 754 (96) | 100 | 1 | 532 (75) | 100 | 1 | 1567 (253) | 100 | 3 | 1374 (324) | 100 | 3 | 54065 (5469) | 100 |

**Table D-3.** For Navigation Pool 13, mean annual catch for fish of all sizes and variance (*in parentheses*) of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program (LTRMP) and the percentage of total annual catch accounted for by that species within a gear (a column) and across all gears (a row). "*N*" is the mean number of independent samples collected annually with one standard error (*in parentheses*). Species are listed in order of abundance in total annual catch for all gears combined. Only species comprising the top 99% of the total catch within Navigation Pool 13 are included, except that species of particular management interest that did not contribute to the top 99% are also included. Data were from stratified random sampling during 1993 through 1999 in the LTRMP Fish Component. (Shaded bars are added for readability.)

| | Day electrofishing *N* = 60.1 (1.5) | | | Night electrofishing *N* = 21.6 (1.4) | | | Bottom trawling *N* = 5.4 (0.4) | | | Seining *N* = 52.0 (2.0) | | | Mini fyke nets *N* = 71.4 (2.8) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears |
| Emerald shiner | 876 (188) | 16 | 9 | 1050 (646) | 21 | 11 | <1 (<1) | <1 | <1 | 6209 (1758) | 32 | 64 | 1352 (448) | 15 | 14 |
| Bluegill | 1011 (225) | 18 | 15 | 507 (94) | 10 | 8 | <1 (<1) | <1 | <1 | 1441 (439) | 7 | 22 | 2275 (582) | 25 | 34 |
| River shiner | 131 (25) | 2 | 2 | 80 (33) | 2 | 1 | <1 (<1) | <1 | <1 | 4492 (809) | 23 | 82 | 757 (321) | 8 | 14 |
| Freshwater drum | 125 (23) | 2 | 3 | 540 (144) | 11 | 13 | 26 (11) | 19 | 1 | 755 (702) | 4 | 18 | 1020 (845) | 11 | 24 |
| Channel shiner | 41 (19) | 1 | 1 | 75 (42) | 2 | 2 | <1 (<1) | <1 | <1 | 2034 (1568) | 10 | 59 | 1178 (787) | 13 | 34 |
| Gizzard shad | 1409 (697) | 25 | 43 | 549 (220) | 11 | 17 | <1 (<1) | <1 | <1 | 556 (163) | 3 | 17 | 340 (199) | 4 | 10 |
| Largemouth bass | 348 (51) | 6 | 25 | 163 (27) | 3 | 12 | <1 (<1) | <1 | <1 | 534 (391) | 3 | 39 | 279 (180) | 3 | 20 |
| White bass | 96 (27) | 2 | 8 | 461 (131) | 9 | 38 | <1 (<1) | <1 | <1 | 104 (24) | 1 | 9 | 256 (85) | 3 | 21 |
| Common carp | 548 (62) | 10 | 46 | 185 (25) | 4 | 16 | 1 (<1) | 1 | <1 | 94 (43) | <1 | 8 | 150 (54) | 2 | 13 |
| Bullhead minnow | 77 (21) | 1 | 7 | 48 (20) | 1 | 4 | <1 (<1) | <1 | <1 | 717 (190) | 4 | 64 | 170 (57) | 2 | 15 |
| Black crappie | 66 (13) | 1 | 6 | 37 (4) | 1 | 3 | <1 (<1) | <1 | <1 | 106 (84) | 1 | 10 | 50 (13) | 1 | 5 |
| Orangespotted sunfish | 121 (36) | 2 | 14 | 96 (31) | 2 | 11 | <1 (<1) | <1 | <1 | 243 (64) | 1 | 29 | 262 (100) | 3 | 31 |
| Mimic shiner | 29 (29) | 1 | 4 | 36 (36) | 1 | 4 | <1 (<1) | <1 | <1 | 516 (516) | 3 | 64 | 216 (216) | 2 | 27 |
| River carpsucker | 36 (14) | 1 | 5 | 69 (33) | 1 | 9 | <1 (<1) | <1 | <1 | 419 (203) | 2 | 55 | 190 (110) | 2 | 25 |
| Smallmouth buffalo | 38 (7) | 1 | 7 | 74 (36) | 2 | 13 | <1 (<1) | <1 | <1 | 38 (25) | <1 | 7 | 6 (4) | <1 | 1 |
| Brook silverside | 18 (8) | <1 | 4 | 28 (13) | 1 | 6 | <1 (<1) | <1 | <1 | 373 (146) | 2 | 82 | 33 (16) | <1 | 7 |
| Pumpkinseed | 62 (19) | 1 | 14 | 17 (4) | <1 | 4 | <1 (<1) | <1 | <1 | 34 (14) | <1 | 8 | 102 (60) | 1 | 23 |
| Sauger | 53 (8) | 1 | 14 | 292 (42) | 6 | 78 | 1 (1) | 1 | <1 | 2 (1) | <1 | <1 | 4 (1) | <1 | 1 |
| Channel catfish | 28 (4) | <1 | 8 | 25 (4) | 1 | 7 | 40 (21) | 30 | 11 | 29 (12) | <1 | 8 | 20 (6) | <1 | 6 |
| White crappie | 55 (8) | 1 | 15 | 17 (5) | <1 | 5 | <1 (<1) | <1 | <1 | 45 (32) | <1 | 13 | 42 (9) | <1 | 12 |
| Spotfin shiner | 57 (10) | 1 | 18 | 8 (2) | <1 | 3 | <1 (<1) | <1 | <1 | 186 (45) | 1 | 59 | 63 (16) | 1 | 20 |
| Shorthead redhorse | 71 (19) | 1 | 27 | 120 (25) | 2 | 45 | 1 (<1) | 1 | <1 | 18 (8) | <1 | 7 | 10 (3) | <1 | 4 |
| Spottail shiner | 18 (4) | <1 | 8 | 5 (2) | <1 | 2 | <1 (<1) | <1 | <1 | 139 (109) | 1 | 61 | 49 (18) | 1 | 21 |
| Johnny darter | 4 (1) | <1 | 2 | 2 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 145 (64) | 1 | 75 | 39 (16) | <1 | 20 |
| Walleye | 31 (6) | 1 | 17 | 128 (25) | 3 | 69 | <1 (<1) | <1 | <1 | 7 (2) | <1 | 4 | 5 (1) | <1 | 3 |
| Silver chub | 23 (8) | <1 | 13 | 54 (9) | 1 | 30 | 6 (4) | 5 | 4 | 72 (26) | <1 | 40 | 15 (7) | <1 | 8 |
| Golden shiner | 40 (13) | 1 | 24 | 14 (6) | <1 | 8 | <1 (<1) | <1 | <1 | 19 (7) | <1 | 11 | 52 (18) | 1 | 32 |
| Shortnose gar | 7 (1) | <1 | 4 | 7 (1) | <1 | 4 | <1 (<1) | <1 | <1 | 6 (2) | <1 | 4 | 32 (5) | <1 | 20 |
| River darter | 1 (1) | <1 | 1 | 1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 32 (14) | <1 | 25 | 86 (45) | 1 | 67 |
| Logperch | 30 (7) | 1 | 28 | 15 (5) | <1 | 13 | <1 (<1) | <1 | <1 | 32 (9) | <1 | 29 | 22 (10) | <1 | 20 |
| Pugnose minnow | 2 (1) | <1 | 2 | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 14 (3) | <1 | 13 | 23 (4) | <1 | 22 |
| Tadpole madtom | 2 (1) | <1 | 2 | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 46 (17) | <1 | 47 | 40 (18) | <1 | 42 |
| Spotted sucker | 26 (4) | <1 | 32 | 8 (2) | <1 | 10 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 1 | 1 (1) | <1 | 1 |
| Yellow perch | 10 (3) | <1 | 14 | 7 (5) | <1 | 10 | <1 (<1) | <1 | <1 | 14 (10) | <1 | 18 | 1 (1) | <1 | 2 |
| Mud darter | 3 (1) | <1 | 4 | 1 (1) | <1 | 2 | <1 (<1) | <1 | <1 | 32 (21) | <1 | 49 | 25 (13) | <1 | 39 |
| Highfin carpsucker | 12 (5) | <1 | 23 | 36 (15) | 1 | 69 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 2 | 1 (1) | <1 | 3 |
| Bowfin | 12 (4) | <1 | 23 | 2 (1) | <1 | 3 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | 9 (2) | <1 | 17 |
| Flathead catfish | 13 (2) | <1 | 25 | 12 (2) | <1 | 24 | 3 (2) | 2 | 6 | <1 (<1) | <1 | <1 | 3 (1) | <1 | 6 |
| Shovelnose sturgeon | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 44 (8) | 33 | 96 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Bigmouth buffalo | 18 (3) | <1 | 47 | 9 (2) | <1 | 23 | <1 (<1) | <1 | <1 | 5 (5) | <1 | 13 | <1 (<1) | <1 | 1 |
| Northern pike | 5 (1) | <1 | 15 | 2 (1) | <1 | 7 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 6 | 3 (1) | <1 | 9 |
| Blue sucker | <1 (<1) | <1 | 43 | <1 (<1) | <1 | 14 | <1 (<1) | <1 | 14 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Goldeye | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 100 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Lake sturgeon | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 100 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Bighead carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Blue catfish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Grass carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Paddlefish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Skipjack herring | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| All species | 5609 (1096) | 100 | 12 | 4909 (996) | 100 | 11 | 132 (30) | 100 | <1 | 19546 (2427) | 100 | 42 | 9220 (1363) | 100 | 20 |

| | Fyke nets *N* = 41.6 (0.4) | | | Large hoop nets *N* = 51.0 (2.0) | | | Small hoop nets *N* = 51.3 (2.0) | | | Tandem fyke nets *N* = 20.6 (0.4) | | | Tandem mini fyke nets *N* = 20.7 (0.3) | | | All gears combined *N* = 395.7 (13.0) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of this species in total annual catch |
| Emerald shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 211 (78) | 7 | 2 | 9698 (2438) | 21 |
| Bluegill | 526 (89) | 29 | 8 | 22 (7) | 3 | <1 | 36 (5) | 11 | 1 | 355 (110) | 23 | 5 | 479 (155) | 17 | 7 | 6652 (976) | 14 |
| River shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 12 (6) | <1 | <1 | 5472 (998) | 12 |
| Freshwater drum | 57 (18) | 3 | 1 | 87 (27) | 13 | 2 | 45 (20) | 14 | 1 | 161 (65) | 10 | 4 | 1377 (1210) | 49 | 33 | 4192 (2970) | 9 |
| Channel shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 92 (77) | 3 | 3 | 3420 (2470) | 7 |
| Gizzard shad | 186 (78) | 10 | 6 | 5 (3) | 1 | <1 | 1 (<1) | <1 | <1 | 169 (60) | 11 | 5 | 64 (18) | 2 | 2 | 3279 (1074) | 7 |
| Largemouth bass | 31 (4) | 2 | 2 | 2 (1) | <1 | <1 | <1 (<1) | <1 | <1 | 12 (3) | 1 | 1 | 4 (1) | <1 | <1 | 1374 (478) | 3 |
| White bass | 87 (27) | 5 | 7 | 11 (3) | 2 | 1 | 7 (4) | 2 | 1 | 166 (57) | 11 | 14 | 21 (10) | 1 | 2 | 1208 (227) | 3 |
| Common carp | 55 (11) | 3 | 5 | 27 (11) | 4 | 2 | 18 (9) | 5 | 1 | 31 (8) | 2 | 3 | 74 (37) | 3 | 6 | 1182 (173) | 3 |
| Bullhead minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 111 (43) | 4 | 10 | 1123 (190) | 2 |
| Black crappie | 414 (78) | 23 | 39 | 34 (11) | 5 | 3 | 12 (5) | 4 | 1 | 300 (59) | 19 | 28 | 51 (27) | 2 | 5 | 1070 (171) | 2 |
| Orangespotted sunfish | 7 (1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 11 (4) | 1 | 1 | 103 (51) | 4 | 12 | 843 (220) | 2 |
| Mimic shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 9 (9) | <1 | 1 | 805 (805) | 2 |
| River carpsucker | 26 (9) | 1 | 3 | 9 (4) | 1 | 1 | 1 (1) | <1 | <1 | 9 (2) | 1 | 1 | <1 (<1) | <1 | <1 | 760 (345) | 2 |
| Smallmouth buffalo | 11 (4) | 1 | 2 | 379 (108) | 58 | 66 | 14 (6) | 4 | 2 | 16 (3) | 1 | 3 | 1 (1) | <1 | <1 | 577 (129) | 1 |
| Brook silverside | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 452 (169) | 1 |
| Pumpkinseed | 115 (31) | 6 | 26 | 1 (1) | <1 | <1 | 1 (<1) | <1 | <1 | 68 (14) | 4 | 15 | 38 (30) | 1 | 9 | 438 (106) | 1 |
| Sauger | 6 (1) | <1 | 2 | 1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 12 (3) | 1 | 3 | 1 (1) | <1 | <1 | 373 (52) | 1 |
| Channel catfish | 8 (2) | <1 | 2 | 25 (11) | 4 | 7 | 169 (49) | 52 | 47 | 4 (1) | <1 | 1 | 13 (8) | <1 | 4 | 360 (51) | 1 |
| White crappie | 84 (9) | 5 | 23 | 12 (5) | 2 | 3 | 3 (1) | 1 | 1 | 73 (17) | 5 | 20 | 28 (12) | 1 | 8 | 358 (50) | 1 |
| Spotfin shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 315 (54) | 1 |
| Shorthead redhorse | 12 (1) | 1 | 4 | 9 (1) | 1 | 4 | 3 (1) | 1 | 1 | 19 (3) | 1 | 7 | 2 (1) | <1 | 1 | 265 (29) | 1 |
| Spottail shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 15 (5) | 1 | 7 | 226 (105) | <1 |
| Johnny darter | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 4 (2) | <1 | 2 | 194 (81) | <1 |
| Walleye | 4 (1) | <1 | 2 | 1 (1) | <1 | <1 | <1 (<1) | <1 | <1 | 5 (1) | <1 | 3 | 2 (1) | <1 | 1 | 184 (35) | <1 |
| Silver chub | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 3 (1) | 1 | 2 | 1 (1) | <1 | 1 | 5 (2) | <1 | 3 | 180 (47) | <1 |
| Golden shiner | 10 (2) | 1 | 6 | 1 (1) | <1 | 1 | 1 (<1) | <1 | <1 | 22 (6) | 1 | 13 | 7 (3) | <1 | 4 | 165 (35) | <1 |
| Shortnose gar | 77 (13) | 4 | 48 | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 27 (5) | 2 | 17 | 4 (2) | <1 | 2 | 162 (12) | <1 |
| River darter | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 8 (4) | <1 | 6 | 129 (62) | <1 |
| Logperch | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 11 (5) | <1 | 10 | 109 (21) | <1 |
| Pugnose minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 66 (53) | 2 | 62 | 107 (57) | <1 |
| Tadpole madtom | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (1) | <1 | 7 | 97 (24) | <1 |
| Spotted sucker | 19 (4) | 1 | 24 | 2 (1) | <1 | 2 | <1 (<1) | <1 | 1 | 22 (5) | 1 | 27 | 1 (<1) | <1 | 1 | 81 (7) | <1 |
| Yellow perch | 10 (3) | 1 | 13 | 1 (1) | <1 | 1 | 1 (<1) | <1 | 1 | 29 (13) | 2 | 38 | 3 (1) | <1 | 3 | 75 (20) | <1 |
| Mud darter | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 4 (2) | <1 | 6 | 65 (36) | <1 |
| Highfin carpsucker | 1 (1) | <1 | 2 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 53 (22) | <1 |
| Bowfin | 25 (4) | 1 | 47 | 1 (<1) | <1 | 1 | <1 (<1) | <1 | 1 | 4 (1) | <1 | 7 | <1 (<1) | <1 | <1 | 52 (8) | <1 |
| Flathead catfish | 2 (1) | <1 | 4 | 10 (2) | 1 | 19 | 7 (1) | 2 | 13 | 1 (<1) | <1 | 1 | 1 (<1) | <1 | 1 | 51 (6) | <1 |
| Shovelnose sturgeon | <1 (<1) | <1 | <1 | 1 (1) | <1 | 3 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 46 (9) | <1 |
| Bigmouth buffalo | 2 (1) | <1 | 4 | 1 (1) | <1 | 3 | <1 (<1) | <1 | 1 | 3 (1) | <1 | 8 | <1 (<1) | <1 | 1 | 39 (9) | <1 |
| Northern pike | 13 (2) | 1 | 40 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 7 (2) | <1 | 22 | <1 (<1) | <1 | <1 | 32 (5) | <1 |
| Blue sucker | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 14 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 14 | 1 (<1) | <1 |
| Goldeye | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Lake sturgeon | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Bighead carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Blue catfish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Grass carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Paddlefish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Skipjack herring | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| All species | 1818 (226) | 100 | 4 | 649 (135) | 100 | 1 | 326 (77) | 100 | 1 | 1539 (130) | 100 | 3 | 2831 (1186) | 100 | 6 | 46578 (4731) | 100 |

**Table D-4.** For Navigation Pool 26, mean annual catch for fish of all sizes and variance (*in parentheses*) of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program (LTRMP) and the percentage of total annual catch accounted for by that species within a gear (a column) and across all gears (a row). "*N*" is the mean number of independent samples collected annually with one standard error (*in parentheses*). Species are listed in order of abundance in total annual catch for all gears combined. Only species comprising the top 99% of the total catch within Navigation Pool 26 are included, except that species of particular management interest that did not contribute to the top 99% are also included. Data were from stratified random sampling during 1993 through 1999 in the LTRMP Fish Component. (Shaded bars are added for readability.)

| | Day electrofishing *N* = 70.7 (6.3) | | | Night electrofishing *N* = 6.0 (0.0) | | | Bottom trawling *N* = 3.0 (0.0) | | | Seining *N* = 35.1 (5.7) | | | Mini fyke nets *N* = 40.3 (4.6) | | | Fyke nets *N* = 22.0 (1.7) | | | Large hoop nets *N* = 50.0 (4.7) | | | Small hoop nets *N* = 50.1 (4.8) | | | Tandem fyke nets *N* = 11.0 (1.0) | | | Tandem mini fyke nets *N* = 11.0 (1.0) | | | All gears combined *N* = 298.0 (30.9) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | |
| Species | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | Percentage of this species in total annual catch |
| Gizzard shad | 5125 (792) | 56 | 51 | 548 (112) | 46 | 5 | 1 (1) | 1 | <1 | 1518 (454) | 34 | 15 | 2289 (1096) | 35 | 23 | 30 (5) | 4 | <1 | 22 (7) | 2 | <1 | 2 (1) | <1 | <1 | 190 (90) | 33 | 2 | 427 (168) | 39 | 4 | 10073 (1644) | 40 |
| Emerald shiner | 373 (80) | 4 | 16 | 12 (3) | 1 | 1 | <1 (<1) | <1 | <1 | 1173 (332) | 26 | 51 | 650 (272) | 10 | 28 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 105 (43) | 10 | 5 | 2312 (592) | 9 |
| Common carp | 1052 (137) | 12 | 50 | 179 (19) | 15 | 9 | 1 (<1) | 1 | <1 | 12 (7) | <1 | 1 | 27 (8) | <1 | 1 | 53 (26) | 6 | 3 | 493 (302) | 47 | 24 | 283 (197) | 36 | 14 | 11 (3) | 2 | 1 | 12 (6) | 1 | 1 | 2095 (591) | 8 |
| Channel shiner | 25 (11) | <1 | 2 | 4 (1) | <1 | <1 | <1 (<1) | <1 | <1 | 429 (195) | 10 | 32 | 889 (738) | 14 | 66 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 6 (3) | 1 | <1 | 1353 (921) | 5 |
| Freshwater drum | 316 (38) | 3 | 25 | 81 (21) | 7 | 6 | 40 (24) | 40 | 3 | 94 (64) | 2 | 7 | 414 (157) | 6 | 32 | 32 (4) | 4 | 3 | 49 (13) | 5 | 4 | 17 (5) | 2 | 1 | 62 (23) | 11 | 5 | 189 (44) | 17 | 15 | 1277 (183) | 5 |
| White bass | 255 (33) | 3 | 28 | 156 (27) | 13 | 17 | <1 (<1) | <1 | <1 | 72 (21) | 2 | 8 | 229 (110) | 4 | 25 | 94 (16) | 12 | 10 | 15 (3) | 1 | 2 | 6 (1) | 1 | 1 | 55 (8) | 10 | 6 | 68 (22) | 6 | 7 | 927 (152) | 4 |
| Channel catfish | 192 (18) | 2 | 21 | 7 (2) | 1 | 1 | 20 (6) | 20 | 2 | 49 (16) | 1 | 5 | 87 (56) | 1 | 10 | 5 (1) | 1 | 1 | 50 (14) | 5 | 6 | 424 (53) | 54 | 47 | 8 (2) | 1 | 1 | 62 (43) | 6 | 7 | 900 (83) | 4 |
| River shiner | 37 (9) | <1 | 4 | 2 (1) | <1 | <1 | <1 (<1) | <1 | <1 | 667 (337) | 15 | 74 | 190 (155) | 3 | 21 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 896 (477) | 4 |
| Western mosquitofish | 43 (27) | <1 | 5 | 1 (1) | <1 | <1 | <1 (<1) | <1 | <1 | 26 (12) | 1 | 3 | 808 (483) | 13 | 92 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 879 (491) | 3 |
| Bluegill | 396 (80) | 4 | 49 | 20 (5) | 2 | 2 | <1 (<1) | <1 | <1 | 7 (2) | <1 | 1 | 118 (39) | 2 | 15 | 171 (50) | 21 | 21 | 5 (3) | <1 | 1 | 9 (5) | 1 | 1 | 43 (10) | 8 | 5 | 36 (13) | 3 | 4 | 802 (117) | 3 |
| Smallmouth buffalo | 225 (29) | 2 | 32 | 58 (16) | 5 | 8 | <1 (<1) | 1 | <1 | 6 (2) | <1 | 1 | 23 (12) | <1 | 3 | 14 (4) | 2 | 2 | 344 (82) | 33 | 49 | 22 (4) | 3 | 3 | 7 (2) | 1 | 1 | 9 (3) | 1 | 1 | 701 (105) | 3 |
| Black crappie | 31 (10) | <1 | 7 | 11 (5) | 1 | 2 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 1 | 50 (14) | 1 | 11 | 211 (114) | 26 | 47 | 5 (3) | <1 | 1 | 4 (3) | 1 | 1 | 119 (89) | 21 | 26 | 20 (11) | 2 | 4 | 451 (239) | 2 |
| Spotfin shiner | 38 (11) | <1 | 9 | 1 (1) | <1 | <1 | <1 (<1) | <1 | <1 | 143 (58) | 3 | 32 | 260 (131) | 4 | 59 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 443 (181) | 2 |
| Orangespotted sunfish | 267 (71) | 3 | 66 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (2) | <1 | <1 | 58 (14) | 1 | 14 | 3 (1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 71 (33) | 6 | 18 | 402 (101) | 2 |
| Shortnose gar | 74 (12) | 1 | 23 | 43 (5) | 4 | 13 | <1 (<1) | <1 | <1 | 3 (1) | <1 | 1 | 51 (10) | 1 | 16 | 109 (20) | 13 | 34 | 3 (1) | <1 | 1 | 1 (1) | <1 | <1 | 34 (12) | 6 | 10 | 12 (5) | 1 | 4 | 324 (51) | 1 |
| Bullhead minnow | 70 (19) | 1 | 34 | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 22 (5) | <1 | 11 | 90 (24) | 1 | 43 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 26 (13) | 2 | 13 | 209 (46) | 1 |
| River carpsucker | 64 (13) | 1 | 37 | 13 (2) | 1 | 7 | <1 (<1) | <1 | <1 | 54 (18) | 1 | 30 | 6 (4) | <1 | 3 | 15 (5) | 2 | 9 | 13 (3) | 1 | 8 | 2 (1) | <1 | 1 | 7 (1) | 1 | 4 | 4 (2) | <1 | 2 | 176 (36) | 1 |
| Bigmouth buffalo | 74 (34) | 1 | 67 | 6 (2) | <1 | 5 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 17 (15) | <1 | 15 | 5 (2) | 1 | 4 | 8 (2) | 1 | 7 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 1 (1) | <1 | 1 | 112 (45) | <1 |
| Largemouth bass | 75 (24) | 1 | 77 | 7 (4) | 1 | 7 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 2 | 10 (3) | <1 | 10 | 4 (2) | <1 | 4 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 98 (30) | <1 |
| White crappie | 14 (3) | <1 | 16 | 5 (1) | <1 | 5 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 14 (3) | <1 | 16 | 30 (10) | 4 | 34 | 2 (<1) | <1 | 2 | 1 (1) | <1 | 1 | 11 (4) | 2 | 13 | 10 (3) | 1 | 11 | 88 (17) | <1 |
| Flathead catfish | 53 (11) | 1 | 62 | 6 (1) | 1 | 8 | <1 (<1) | 1 | <1 | 1 (<1) | <1 | 1 | 2 (<1) | <1 | 2 | 3 (1) | <1 | 4 | 12 (3) | 1 | 15 | 6 (1) | 1 | 7 | 2 (1) | <1 | 2 | <1 (<1) | <1 | <1 | 84 (15) | <1 |
| Skipjack herring | 50 (15) | 1 | 64 | 2 (1) | <1 | 3 | <1 (<1) | <1 | <1 | 23 (12) | 1 | 30 | 1 (<1) | <1 | 1 | <1 (<1) | <1 | 1 | 1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 1 | 78 (21) | <1 |
| Silverband shiner | 6 (2) | <1 | 8 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 9 (5) | <1 | 12 | 44 (23) | 1 | 61 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 14 (4) | 1 | 19 | 73 (22) | <1 |
| Sauger | 41 (7) | <1 | 58 | 13 (3) | 1 | 18 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 2 | 7 (1) | <1 | 10 | 4 (1) | <1 | 5 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 4 (2) | 1 | 5 | 3 (1) | <1 | 4 | 71 (12) | <1 |
| Red shiner | 4 (2) | <1 | 6 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 23 (10) | 1 | 37 | 35 (19) | 1 | 57 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 62 (24) | <1 |
| Silver chub | 13 (4) | <1 | 28 | 1 (1) | <1 | 2 | <1 (<1) | <1 | <1 | 16 (4) | <1 | 33 | 8 (4) | <1 | 16 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 10 (4) | 1 | 21 | 49 (12) | <1 |
| Black buffalo | 23 (4) | <1 | 54 | 2 (1) | <1 | 4 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 3 | 13 (5) | 1 | 31 | 2 (1) | <1 | 6 | 1 (1) | <1 | 2 | 1 (<1) | <1 | 2 | 43 (9) | <1 |
| Goldeye | 20 (18) | <1 | 53 | 8 (4) | 1 | 20 | <1 (<1) | <1 | <1 | 7 (6) | <1 | 17 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 4 (2) | <1 | 10 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 38 (27) | <1 |
| Miss. silvery minnow | 3 (2) | <1 | 8 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 6 (3) | <1 | 18 | 23 (14) | <1 | 74 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 31 (18) | <1 |
| Brook silverside | 5 (2) | <1 | 17 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 20 (11) | <1 | 69 | 4 (2) | <1 | 12 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | 29 (14) | <1 |
| Green sunfish | 24 (9) | <1 | 83 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 4 (2) | <1 | 13 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 2 | <1 (<1) | <1 | 1 | 29 (11) | <1 |
| Shovelnose sturgeon | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | 28 (20) | 28 | 100 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 28 (18) | <1 |
| Mooneye | 9 (6) | <1 | 32 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | 16 (9) | <1 | 61 | 1 (1) | <1 | 5 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 2 | 27 (14) | <1 |
| Bighead carp | <1 (<1) | <1 | 3 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 8 | 1 (<1) | <1 | 7 | 1 (1) | <1 | 8 | 8 (3) | 1 | 63 | <1 (<1) | <1 | 1 | 1 (1) | <1 | 10 | <1 (<1) | <1 | 1 | 13 (5) | <1 |
| Blue catfish | <1 (<1) | <1 | 5 | <1 (<1) | <1 | <1 | 3 (1) | 3 | 34 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 3 (1) | <1 | 29 | 3 (1) | <1 | 35 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 2 | 9 (3) | <1 |
| Grass carp | 2 (1) | <1 | 35 | 1 (<1) | <1 | 14 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 8 | 3 (3) | <1 | 45 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (3) | <1 |
| Walleye | 2 (1) | <1 | 30 | 2 (1) | <1 | 44 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 3 | 1 (<1) | <1 | 14 | <1 (<1) | <1 | 8 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 8 | <1 (<1) | <1 | <1 | 5 (1) | <1 |
| Blue sucker | 1 (<1) | <1 | 44 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 33 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 22 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 |
| Lake sturgeon | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | 1 | 100 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 |
| Silver carp | 1 (<1) | <1 | 80 | <1 (<1) | <1 | 23 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 |
| Paddlefish | <1 (<1) | <1 | 33 | <1 (<1) | <1 | 39 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 33 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Northern pike | <1 (<1) | <1 | 50 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 50 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| All species | 9076 (854) | 100 | 36 | 1201 (124) | 100 | 5 | 101 (26) | 100 | <1 | 4430 (936) | 100 | 17 | 6457 (1504) | 100 | 25 | 816 (218) | 100 | 3 | 1052 (308) | 100 | 4 | 788 (221) | 100 | 3 | 568 (119) | 100 | 2 | 1104 (176) | 100 | 4 | 25410 (2595) | 100 |

**Table D-5.** For Open River, mean annual catch for fish of all sizes and variance (*in parentheses*) of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program (LTRMP) and the percentage of total annual catch accounted for by that species within a gear (a column) and across all gears (a row). "*N*" is the mean number of independent samples collected annually with one standard error (*in parentheses*). Species are listed in order of abundance in total annual catch for all gears combined. Only species comprising the top 99% of the total catch within Open River are included, except that species of particular management interest that did not contribute to the top 99% are also included. Data were from stratified random sampling during 1993 through 1999 in the LTRMP Fish Component. (Shaded bars are added for readability.)

| Species | Day electrofishing *N* = 43.7 (5.1) | | | Night electrofishing *N* = 0 | | | Bottom trawling *N* = 16.5 (9.1) | | | Seining *N* = 6.8 (1.2) | | | Mini fyke nets *N* = 60.1 (4.8) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears |
| Gizzard shad | 4090 (863) | 68 | 75 | - | - | - | 1 (1) | <1 | <1 | 282 (88) | 48 | 5 | 898 (406) | 12 | 17 |
| Freshwater drum | 162 (20) | 3 | 3 | - | - | - | 87 (40) | 44 | 2 | 9 (4) | 1 | <1 | 4323 (1419) | 57 | 91 |
| Black crappie | 13 (2) | <1 | 1 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 65 (27) | 1 | 6 |
| Common carp | 255 (54) | 4 | 26 | - | - | - | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 71 (33) | 1 | 7 |
| Channel shiner | 35 (18) | 1 | 5 | - | - | - | 20 (19) | 10 | 3 | 22 (15) | 4 | 3 | 627 (325) | 8 | 90 |
| Channel catfish | 94 (18) | 2 | 14 | - | - | - | 55 (27) | 28 | 8 | 18 (5) | 3 | 3 | 146 (39) | 2 | 21 |
| Emerald shiner | 177 (62) | 3 | 30 | - | - | - | <1 (<1) | <1 | <1 | 132 (72) | 22 | 22 | 297 (133) | 4 | 51 |
| White bass | 125 (22) | 2 | 25 | - | - | - | 1 (<1) | <1 | <1 | 11 (4) | 2 | 2 | 114 (35) | 2 | 22 |
| Bluegill | 93 (17) | 2 | 21 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 302 (126) | 4 | 68 |
| Red shiner | 173 (66) | 3 | 50 | - | - | - | <1 (<1) | <1 | <1 | 26 (14) | 4 | 7 | 148 (69) | 2 | 43 |
| Goldeye | 253 (124) | 4 | 88 | - | - | - | <1 (<1) | <1 | <1 | 5 (3) | 1 | 2 | 26 (12) | <1 | 9 |
| Smallmouth buffalo | 63 (11) | 1 | 25 | - | - | - | <1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 1 (1) | <1 | <1 |
| River carpsucker | 35 (7) | 1 | 18 | - | - | - | <1 (<1) | <1 | <1 | 16 (10) | 3 | 8 | 50 (43) | 1 | 26 |
| White crappie | 30 (12) | <1 | 17 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 84 (32) | 1 | 46 |
| Shortnose gar | 58 (13) | 1 | 39 | - | - | - | <1 (<1) | <1 | <1 | 2 (<1) | <1 | 1 | 22 (5) | <1 | 15 |
| Silverband shiner | 16 (5) | <1 | 13 | - | - | - | 1 (1) | 1 | 1 | 6 (2) | 1 | 5 | 102 (37) | 1 | 83 |
| Flathead catfish | 45 (8) | 1 | 40 | - | - | - | 1 (1) | 1 | 1 | <1 (<1) | <1 | <1 | 8 (2) | <1 | 7 |
| Black buffalo | 10 (2) | <1 | 15 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| River shiner | 17 (11) | <1 | 25 | - | - | - | <1 (<1) | <1 | <1 | 37 (17) | 6 | 54 | 19 (8) | <1 | 28 |
| Orangespotted sunfish | 26 (13) | <1 | 49 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 26 (10) | <1 | 47 |
| Bigmouth buffalo | 27 (10) | <1 | 51 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 19 (18) | <1 | 36 |
| Miss. silvery minnow | 5 (3) | <1 | 11 | - | - | - | <1 (<1) | <1 | <1 | 13 (6) | 2 | 28 | 31 (25) | <1 | 66 |
| Spotted bass | 37 (15) | 1 | 93 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 3 (1) | <1 | 7 |
| Blue catfish | 8 (3) | <1 | 20 | - | - | - | 11 (5) | 6 | 30 | 1 (1) | <1 | 2 | 3 (1) | <1 | 8 |
| Brook silverside | 30 (17) | 1 | 90 | - | - | - | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 1 | 3 (1) | <1 | 8 |
| Green sunfish | 19 (12) | <1 | 59 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (2) | <1 | 23 |
| Threadfin shad | 17 (9) | <1 | 57 | - | - | - | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 2 | 12 (10) | <1 | 40 |
| Western mosquitofish | 12 (8) | <1 | 42 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | 16 (4) | <1 | 57 |
| Sauger | 10 (3) | <1 | 40 | - | - | - | <1 (<1) | <1 | 1 | 2 (1) | <1 | 7 | 10 (4) | <1 | 41 |
| Silver chub | 6 (2) | <1 | 28 | - | - | - | 1 (<1) | <1 | 3 | 2 (1) | <1 | 9 | 15 (4) | <1 | 63 |
| Largemouth bass | 18 (5) | <1 | 83 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 3 |
| Skipjack herring | 12 (5) | <1 | 57 | - | - | - | <1 (<1) | <1 | 1 | 4 (2) | 1 | 17 | 5 (2) | <1 | 26 |
| Yellow bass | 1 (<1) | <1 | 4 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 4 |
| Bullhead minnow | 2 (1) | <1 | 16 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 13 (5) | <1 | 84 |
| Warmouth | 6 (4) | <1 | 42 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 9 (3) | <1 | 58 |
| Longnose gar | 6 (1) | <1 | 46 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 5 (2) | <1 | 41 |
| Bighead carp | 1 (1) | <1 | 5 | - | - | - | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 6 | 8 (4) | <1 | 74 |
| Shovelnose sturgeon | <1 (<1) | <1 | 3 | - | - | - | 10 (4) | 5 | 91 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 6 |
| Blue sucker | 4 (2) | <1 | 54 | - | - | - | <1 (<1) | <1 | 5 | <1 (<1) | <1 | <1 | 3 (2) | <1 | 41 |
| Grass carp | <1 (<1) | <1 | 18 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 14 | <1 (<1) | <1 | 6 |
| Paddlefish | <1 (<1) | <1 | <1 | - | - | - | 1 (1) | <1 | 73 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 13 |
| Walleye | 1 (1) | <1 | 80 | - | - | - | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Lake sturgeon | 0 (0) | 0 | 0 | - | - | - | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Northern pike | 0 (0) | 0 | 0 | - | - | - | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Silver carp | 0 (0) | 0 | 0 | - | - | - | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| All species | 6042 (983) | 100 | 34 | - | - | - | 198 (99) | 100 | 1 | 590 (121) | 100 | 3 | 7548 (1608) | 100 | 43 |

| Species | Fyke nets *N* = 19.9 (1.2) | | | Large hoop nets *N* = 51.1 (6.1) | | | Small hoop nets *N* = 52.1 (6.3) | | | Tandem fyke nets *N* = 0 | | | Tandem mini fyke nets *N* = 0 | | | All gears combined *N* = 247.0 (27.9) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of annual catch: This gear | All gears | Mean annual catch | Percentage of annual catch: This gear | All gears | Mean annual catch | Percentage of annual catch: This gear | All gears | Mean annual catch (variance) | Percentage of this species in total annual catch |
| Gizzard shad | 194 (177) | 10 | 4 | 10 (4) | 1 | <1 | 1 (1) | <1 | <1 | - | - | - | - | - | - | 5436 (1180) | 31 |
| Freshwater drum | 100 (23) | 5 | 2 | 63 (18) | 7 | 1 | 10 (2) | 2 | <1 | - | - | - | - | - | - | 4740 (1451) | 27 |
| Black crappie | 1020 (981) | 55 | 92 | 1 (1) | <1 | <1 | 9 (7) | 1 | 1 | - | - | - | - | - | - | 1107 (1003) | 6 |
| Common carp | 33 (8) | 2 | 3 | 396 (179) | 43 | 40 | 224 (105) | 37 | 23 | - | - | - | - | - | - | 980 (304) | 6 |
| Channel shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 697 (352) | 4 |
| Channel catfish | 9 (3) | <1 | 1 | 94 (32) | 10 | 14 | 278 (62) | 46 | 41 | - | - | - | - | - | - | 682 (104) | 4 |
| Emerald shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 586 (226) | 3 |
| White bass | 245 (189) | 13 | 48 | 7 (2) | 1 | 1 | 9 (7) | 2 | 2 | - | - | - | - | - | - | 510 (200) | 3 |
| Bluegill | 32 (16) | 2 | 7 | 1 (1) | <1 | <1 | 16 (13) | 3 | 4 | - | - | - | - | - | - | 444 (165) | 3 |
| Red shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 343 (104) | 2 |
| Goldeye | 5 (4) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 288 (137) | 2 |
| Smallmouth buffalo | 11 (9) | 1 | 4 | 169 (42) | 18 | 66 | 11 (2) | 2 | 4 | - | - | - | - | - | - | 256 (36) | 1 |
| River carpsucker | 15 (1) | 1 | 8 | 73 (31) | 8 | 39 | 4 (1) | 1 | 2 | - | - | - | - | - | - | 190 (56) | 1 |
| White crappie | 61 (32) | 3 | 34 | 4 (2) | <1 | 2 | 2 (1) | <1 | 1 | - | - | - | - | - | - | 182 (46) | 1 |
| Shortnose gar | 61 (21) | 3 | 41 | 3 (1) | <1 | 2 | 3 (1) | 1 | 2 | - | - | - | - | - | - | 148 (32) | 1 |
| Silverband shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 123 (43) | 1 |
| Flathead catfish | 11 (3) | 1 | 10 | 29 (7) | 3 | 26 | 18 (7) | 3 | 16 | - | - | - | - | - | - | 112 (21) | 1 |
| Black buffalo | 2 (1) | <1 | 3 | 49 (11) | 5 | 71 | 8 (2) | 1 | 11 | - | - | - | - | - | - | 69 (13) | <1 |
| River shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 67 (19) | <1 |
| Orangespotted sunfish | 2 (2) | <1 | 4 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 54 (22) | <1 |
| Bigmouth buffalo | 2 (2) | <1 | 5 | 4 (1) | <1 | 8 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 53 (19) | <1 |
| Miss. silvery minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 47 (29) | <1 |
| Spotted bass | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 40 (16) | <1 |
| Blue catfish | 1 (<1) | <1 | 2 | 5 (1) | 1 | 13 | 11 (5) | 2 | 30 | - | - | - | - | - | - | 40 (8) | <1 |
| Brook silverside | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 34 (17) | <1 |
| Green sunfish | 6 (6) | <1 | 18 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 32 (19) | <1 |
| Threadfin shad | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 30 (19) | <1 |
| Western mosquitofish | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 28 (11) | <1 |
| Sauger | 3 (1) | <1 | 10 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | - | - | - | - | - | - | 25 (5) | <1 |
| Silver chub | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 23 (5) | <1 |
| Largemouth bass | 3 (3) | <1 | 14 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 22 (6) | <1 |
| Skipjack herring | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 21 (7) | <1 |
| Yellow bass | 18 (13) | 1 | 91 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | 1 | - | - | - | - | - | - | 20 (13) | <1 |
| Bullhead minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 15 (5) | <1 |
| Warmouth | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 15 (5) | <1 |
| Longnose gar | 1 (1) | <1 | 8 | 1 (<1) | <1 | 6 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 13 (3) | <1 |
| Bighead carp | <1 (<1) | <1 | 3 | 1 (<1) | <1 | 12 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 11 (5) | <1 |
| Shovelnose sturgeon | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 4 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 10 (4) | <1 |
| Blue sucker | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 7 (3) | <1 |
| Grass carp | <1 (<1) | <1 | <1 | 1 (1) | <1 | 59 | <1 (<1) | <1 | 6 | - | - | - | - | - | - | 2 (1) | <1 |
| Paddlefish | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 25 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 1 (1) | <1 |
| Walleye | <1 (<1) | <1 | 20 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | - | - | - | - | - | - | 1 (1) | <1 |
| Lake sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | - | - | - | - | - | - | 0 (0) | 0 |
| Northern pike | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | - | - | - | - | - | - | 0 (0) | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | - | - | - | - | - | - | 0 (0) | 0 |
| All species | 1852 (1433) | 100 | 10 | 917 (224) | 100 | 5 | 607 (166) | 100 | 3 | - | - | - | - | - | - | 17642 (1401) | 100 |

**Table D-6.** For La Grange Pool, mean annual catch for fish of all sizes and variance (*in parentheses*) of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program (LTRMP) and the percentage of total annual catch accounted for by that species within a gear (a column) and across all gears (a row). "*N*" is the mean number of independent samples collected annually with one standard error (*in parentheses*). Species are listed in order of abundance in total annual catch for all gears combined. Only species comprising the top 99% of the total catch within La Grange Pool are included, except that species of particular management interest that did not contribute to the top 99% are also included. Data were from stratified random sampling during 1993 through 1999 in the LTRMP Fish Component. (Shaded bars are added for readability.)

| | Day electrofishing *N* = 107.7 (10.8) | | | Night electrofishing *N* = 27.3 (7.6) | | | Bottom trawling *N* = 11.4 (0.4) | | | Seining *N* = 44.3 (2.5) | | | Mini fyke nets *N* = 82.7 (4.7) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gear | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears |
| Gizzard shad | 19039 (6253) | 67 | 42 | 2361 (551) | 43 | 5 | 7 (7) | 6 | <1 | 4297 (1729) | 61 | 9 | 18167 (8254) | 61 | 40 |
| Emerald shiner | 696 (194) | 2 | 9 | 91 (29) | 2 | 1 | <1 (<1) | <1 | <1 | 1042 (230) | 15 | 14 | 5654 (1759) | 19 | 75 |
| White bass | 1341 (268) | 5 | 26 | 654 (83) | 12 | 13 | 1 (1) | 1 | <1 | 241 (124) | 3 | 5 | 1048 (344) | 4 | 20 |
| Common carp | 1996 (404) | 7 | 43 | 805 (460) | 15 | 17 | 5 (3) | 5 | <1 | 13 (5) | <1 | <1 | 176 (94) | 1 | 4 |
| Bluegill | 1325 (253) | 5 | 28 | 343 (165) | 6 | 7 | <1 (<1) | <1 | <1 | 273 (83) | 4 | 6 | 1559 (763) | 5 | 33 |
| Freshwater drum | 516 (96) | 2 | 15 | 372 (172) | 7 | 10 | 44 (16) | 42 | 1 | 94 (46) | 1 | 3 | 1481 (642) | 5 | 42 |
| Black crappie | 371 (72) | 1 | 17 | 90 (59) | 2 | 4 | <1 (<1) | <1 | <1 | 22 (6) | <1 | 1 | 176 (35) | 1 | 8 |
| Channel catfish | 194 (40) | 1 | 11 | 43 (23) | 1 | 2 | 40 (8) | 38 | 2 | 20 (7) | <1 | 1 | 121 (37) | <1 | 7 |
| Smallmouth buffalo | 664 (105) | 2 | 39 | 303 (119) | 5 | 18 | <1 (<1) | <1 | <1 | 76 (48) | 1 | 4 | 20 (5) | <1 | 1 |
| White crappie | 240 (61) | 1 | 29 | 53 (22) | 1 | 7 | <1 (<1) | <1 | <1 | 16 (5) | <1 | 2 | 119 (31) | <1 | 15 |
| Largemouth bass | 434 (97) | 2 | 62 | 84 (33) | 2 | 12 | <1 (<1) | <1 | <1 | 79 (43) | 1 | 11 | 66 (16) | <1 | 9 |
| Threadfin shad | 239 (87) | 1 | 39 | 18 (6) | <1 | 3 | <1 (<1) | <1 | <1 | 186 (134) | 3 | 30 | 85 (37) | <1 | 14 |
| Bigmouth buffalo | 462 (81) | 2 | 80 | 78 (28) | 1 | 13 | <1 (<1) | <1 | <1 | 15 (9) | <1 | 3 | 5 (3) | <1 | 1 |
| Skipjack herring | 289 (174) | 1 | 65 | 10 (4) | <1 | 2 | <1 (<1) | <1 | <1 | 62 (45) | 1 | 14 | 10 (4) | <1 | 2 |
| Western mosquitofish | 6 (3) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 205 (90) | 3 | 55 | 158 (109) | 1 | 43 |
| Sauger | 113 (27) | <1 | 38 | 82 (27) | 1 | 27 | 3 (2) | 3 | 1 | 8 (2) | <1 | 3 | 51 (16) | <1 | 17 |
| Shortnose gar | 28 (3) | <1 | 11 | 14 (2) | <1 | 6 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 1 | 49 (13) | <1 | 19 |
| River carpsucker | 68 (16) | <1 | 29 | 15 (3) | <1 | 6 | <1 (<1) | <1 | <1 | 21 (5) | <1 | 9 | 7 (2) | <1 | 3 |
| Bullhead minnow | 26 (9) | <1 | 12 | 2 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 122 (35) | 2 | 56 | 63 (23) | <1 | 29 |
| Red shiner | 22 (7) | <1 | 13 | 8 (4) | <1 | 5 | <1 (<1) | <1 | <1 | 74 (33) | 1 | 43 | 67 (23) | <1 | 39 |
| Shorthead redhorse | 48 (15) | <1 | 31 | 12 (6) | <1 | 8 | 1 (1) | 1 | 1 | 2 (1) | <1 | 2 | 7 (5) | <1 | 5 |
| Golden shiner | 21 (12) | <1 | 17 | 3 (1) | <1 | 3 | <1 (<1) | <1 | <1 | 38 (20) | 1 | 31 | 56 (34) | <1 | 45 |
| Brown bullhead | 3 (1) | <1 | 3 | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 9 (3) | <1 | 8 |
| Yellow bass | 27 (6) | <1 | 28 | 16 (5) | <1 | 17 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 6 (2) | <1 | 6 |
| Yellow bullhead | 11 (5) | <1 | 12 | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 27 (12) | <1 | 30 |
| Brook silverside | 17 (6) | <1 | 20 | 7 (4) | <1 | 8 | <1 (<1) | <1 | <1 | 37 (9) | 1 | 42 | 26 (14) | <1 | 29 |
| Black bullhead | 5 (2) | <1 | 6 | 2 (1) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 42 (10) | <1 | 54 |
| Silverband shiner | 8 (5) | <1 | 11 | 2 (1) | <1 | 3 | <1 (<1) | <1 | <1 | 15 (8) | <1 | 21 | 46 (22) | <1 | 64 |
| Flathead catfish | 34 (6) | <1 | 47 | 11 (1) | <1 | 15 | 1 (<1) | 1 | 2 | <1 (<1) | <1 | <1 | 5 (1) | <1 | 7 |
| Bluntnose minnow | 1 (1) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (3) | <1 | 10 | 60 (54) | <1 | 88 |
| Grass carp | 12 (6) | <1 | 25 | 2 (1) | <1 | 4 | <1 (<1) | <1 | <1 | 4 (4) | <1 | 8 | 28 (26) | <1 | 59 |
| Goldeye | 10 (7) | <1 | 57 | 4 (1) | <1 | 20 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 |
| Walleye | 3 (1) | <1 | 23 | 4 (1) | <1 | 26 | <1 (<1) | <1 | 3 | 1 (<1) | <1 | 4 | <1 (<1) | <1 | 2 |
| Northern pike | <1 (<1) | <1 | 4 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 21 |
| Blue catfish | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Bighead carp | <1 (<1) | <1 | 14 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Paddlefish | <1 (<1) | <1 | 67 | <1 (<1) | <1 | 33 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Silver carp | <1 (<1) | <1 | 100 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Blue sucker | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Lake sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Shovelnose sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| All species | 28470 (7001) | 100 | 34 | 5540 (1144) | 100 | 7 | 106 (25) | 100 | <1 | 7095 (1899) | 100 | 9 | 29606 (9741) | 100 | 36 |

| | Fyke nets *N* = 36.6 (3.4) | | | Large hoop nets *N* = 61.6 (2.2) | | | Small hoop nets *N* = 62.3 (2.6) | | | Tandem fyke nets *N* = 14.6 (1.2) | | | Tandem mini fyke nets *N* = 14.6 (1.2) | | | All gears combined *N* = 463.0 (19.4) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | Percentage of this species in total annual catch |
| Gizzard shad | 375 (64) | 7 | 1 | 56 (23) | 3 | <1 | 5 (3) | <1 | <1 | 616 (92) | 30 | 1 | 689 (307) | 43 | 2 | 45612 (15178) | 55 |
| Emerald shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 55 (40) | 3 | 1 | 7538 (2069) | 9 |
| White bass | 1413 (314) | 28 | 27 | 38 (10) | 2 | 1 | 22 (8) | 1 | <1 | 379 (171) | 18 | 7 | 50 (19) | 3 | 1 | 5187 (921) | 6 |
| Common carp | 120 (23) | 2 | 3 | 958 (198) | 55 | 20 | 580 (119) | 30 | 12 | 24 (6) | 1 | 1 | 9 (3) | 1 | <1 | 4687 (1097) | 6 |
| Bluegill | 833 (174) | 16 | 18 | 2 (1) | <1 | <1 | 18 (8) | 1 | <1 | 228 (44) | 11 | 5 | 74 (28) | 5 | 2 | 4655 (1034) | 6 |
| Freshwater drum | 241 (31) | 5 | 7 | 92 (11) | 5 | 3 | 18 (3) | 1 | <1 | 106 (17) | 5 | 3 | 582 (273) | 36 | 16 | 3546 (756) | 4 |
| Black crappie | 1087 (271) | 21 | 51 | 5 (2) | <1 | <1 | 4 (3) | <1 | <1 | 366 (169) | 18 | 17 | 12 (5) | 1 | 1 | 2134 (533) | 3 |
| Channel catfish | 22 (7) | <1 | 1 | 79 (14) | 4 | 4 | 1207 (599) | 63 | 69 | 7 (2) | <1 | <1 | 26 (21) | 2 | 1 | 1759 (598) | 2 |
| Smallmouth buffalo | 141 (28) | 3 | 8 | 444 (75) | 25 | 26 | 30 (9) | 2 | 2 | 37 (10) | 2 | 2 | 4 (2) | <1 | <1 | 1720 (168) | 2 |
| White crappie | 260 (71) | 5 | 32 | 5 (3) | <1 | 1 | 5 (3) | <1 | 1 | 103 (42) | 5 | 13 | 14 (5) | 1 | 2 | 816 (185) | 1 |
| Largemouth bass | 26 (9) | 1 | 4 | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 6 (3) | <1 | 1 | <1 (<1) | <1 | <1 | 695 (129) | 1 |
| Threadfin shad | 31 (10) | 1 | 5 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 26 (18) | 1 | 4 | 32 (16) | 2 | 5 | 618 (236) | 1 |
| Bigmouth buffalo | 9 (3) | <1 | 2 | 3 (1) | <1 | <1 | <1 (<1) | <1 | <1 | 4 (1) | <1 | 1 | 2 (1) | <1 | <1 | 577 (91) | 1 |
| Skipjack herring | 37 (21) | 1 | 8 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 3 (2) | <1 | 1 | 33 (29) | 2 | 7 | 445 (207) | 1 |
| Western mosquitofish | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 369 (124) | <1 |
| Sauger | 29 (7) | 1 | 10 | 1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 8 (1) | <1 | 3 | 3 (2) | <1 | 1 | 299 (52) | <1 |
| Shortnose gar | 127 (29) | 3 | 51 | 2 (1) | <1 | 1 | 1 (<1) | <1 | <1 | 24 (6) | 1 | 10 | 4 (1) | <1 | 2 | 252 (45) | <1 |
| River carpsucker | 75 (10) | 1 | 32 | 24 (7) | 1 | 10 | 1 (<1) | <1 | <1 | 23 (6) | 1 | 10 | 1 (<1) | <1 | <1 | 234 (25) | <1 |
| Bullhead minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 3 (1) | <1 | 1 | 217 (37) | <1 |
| Red shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 171 (47) | <1 |
| Shorthead redhorse | 61 (14) | 1 | 40 | 2 (1) | <1 | 1 | 1 (<1) | <1 | <1 | 18 (6) | 1 | 12 | <1 (<1) | <1 | <1 | 153 (41) | <1 |
| Golden shiner | 3 (1) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 1 (1) | <1 | 1 | 123 (54) | <1 |
| Brown bullhead | 42 (20) | 1 | 36 | 12 (5) | 1 | 11 | 16 (9) | 1 | 14 | 31 (8) | 1 | 26 | 1 (1) | <1 | 1 | 116 (23) | <1 |
| Yellow bass | 25 (10) | 1 | 27 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 15 (6) | 1 | 16 | 4 (4) | <1 | 4 | 95 (22) | <1 |
| Yellow bullhead | 28 (9) | 1 | 32 | 1 (1) | <1 | 1 | 1 (1) | <1 | 1 | 16 (7) | 1 | 18 | 4 (1) | <1 | 4 | 88 (17) | <1 |
| Brook silverside | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 87 (20) | <1 |
| Black bullhead | 13 (4) | <1 | 17 | 1 (1) | <1 | 2 | 3 (1) | <1 | 4 | 8 (2) | <1 | 11 | 3 (2) | <1 | 4 | 77 (14) | <1 |
| Silverband shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 72 (33) | <1 |
| Flathead catfish | 3 (1) | <1 | 5 | 11 (2) | 1 | 15 | 6 (2) | <1 | 8 | 1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 72 (9) | <1 |
| Bluntnose minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 68 (55) | <1 |
| Grass carp | 1 (1) | <1 | 2 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 47 (30) | <1 |
| Goldeye | 3 (2) | <1 | 18 | <1 (<1) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 2 | <1 (<1) | <1 | <1 | 18 (8) | <1 |
| Walleye | 5 (2) | <1 | 33 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 7 | <1 (<1) | <1 | 2 | 15 (2) | <1 |
| Northern pike | 2 (1) | <1 | 63 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 13 | <1 (<1) | <1 | <1 | 3 (2) | <1 |
| Blue catfish | <1 (<1) | <1 | <1 | 1 (1) | <1 | 40 | 1 (1) | <1 | 60 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 |
| Bighead carp | 1 (<1) | <1 | 57 | <1 (<1) | <1 | 14 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 14 | <1 (<1) | <1 | <1 | 1 (<1) | <1 |
| Paddlefish | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Silver carp | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Blue sucker | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Lake sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Shovelnose sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| All species | 5082 (585) | 100 | 6 | 1749 (238) | 10 | 2 | 1922 (732) | 100 | 2 | 2064 (328) | 100 | 2 | 1616 (444) | 100 | 2 | 83251 (17136) | 100 |

## Appendix E. Catch by Gear Type for Fish Less Than 120 mm

Appendix E contains six tables, one for each trend analysis area, listing mean annual catch and variance of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program and the percentage of total annual catch accounted for by that species within each gear and across all gears. Only fish <120 mm in total length were included in these analyses. Information on how each gear is fished and what constitutes an independent sample can be found in Gutreuter et al. (1995.)

**Table E-1.** For Navigation Pool 4, mean annual catch of fish <120 mm in total length and variance (*in parentheses*) of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program (LTRMP) and the percentage of total annual catch accounted for by that species within a gear (a column) and across all gears (a row). "*N*" is the mean number of independent samples collected annually with one standard error (*in parentheses*). Species are listed in order of abundance in total annual catch for all gears combined. Only species comprising the top 99% of the total catch within Navigation Pool 4 are included, except that species of particular management interest that did not contribute to the top 99% are also included. Data were from stratified random sampling during 1993 through 1999 in the LTRMP Fish Component. (Shaded bars are added for readability.)

| | Day electrofishing *N* = 81.3 (1.8) | | | Night electrofishing *N* = 11.7 (0.2) | | | Bottom trawling *N* = 4.0 (0.8) | | | Seining *N* = 30.4 (2.2) | | | Mini fyke nets *N* = 61.1 (2.5) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears |
| Emerald shiner | 4030 (1088) | 63 | 8 | 4951 (4951) | 78 | 10 | <1 (<1) | 1 | <1 | 8713 (2904) | 73 | 17 | 34116 (18016) | 94 | 66 |
| Gizzard shad | 637 (96) | 10 | 32 | 1109 (1109) | 18 | 56 | <1 (<1) | 1 | <1 | 92 (47) | 1 | 5 | 92 (35) | <1 | 5 |
| Spotfin shiner | 218 (59) | 3 | 12 | 6 (6) | <1 | <1 | <1 (<1) | <1 | <1 | 1396 (335) | 12 | 76 | 212 (70) | 1 | 12 |
| Bluegill | 353 (36) | 6 | 27 | 68 (68) | 1 | 5 | <1 (<1) | <1 | <1 | 100 (45) | 1 | 8 | 488 (131) | 1 | 37 |
| Mimic shiner | 29 (11) | <1 | 3 | 3 (3) | <1 | <1 | <1 (<1) | <1 | <1 | 517 (210) | 4 | 54 | 388 (122) | 1 | 41 |
| Bullhead minnow | 56 (26) | 1 | 8 | 3 (3) | <1 | <1 | <1 (<1) | <1 | <1 | 404 (137) | 3 | 61 | 163 (74) | <1 | 25 |
| White bass | 130 (51) | 2 | 21 | 88 (88) | 1 | 14 | <1 (<1) | <1 | <1 | 101 (45) | 1 | 16 | 206 (115) | 1 | 33 |
| Black crappie | 34 (14) | 1 | 10 | 3 (3) | <1 | 1 | <1 (<1) | <1 | <1 | 8 (2) | <1 | 2 | 30 (9) | <1 | 9 |
| River shiner | 99 (32) | 2 | 38 | 2 (2) | <1 | 1 | <1 (<1) | <1 | <1 | 150 (36) | 1 | 57 | 11 (4) | <1 | 4 |
| Largemouth bass | 151 (26) | 2 | 63 | 9 (9) | <1 | 4 | <1 (<1) | <1 | <1 | 20 (7) | <1 | 8 | 56 (36) | <1 | 24 |
| Logperch | 95 (32) | 1 | 44 | 13 (13) | <1 | 6 | <1 (<1) | <1 | <1 | 41 (9) | <1 | 19 | 49 (20) | <1 | 23 |
| Spottail shiner | 58 (17) | 1 | 31 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 56 (24) | <1 | 30 | 33 (13) | <1 | 17 |
| Yellow perch | 119 (37) | 2 | 75 | 1 (1) | <1 | <1 | <1 (<1) | <1 | <1 | 19 (10) | <1 | 12 | 11 (5) | <1 | 7 |
| Johnny darter | 10 (1) | <1 | 7 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 85 (15) | 1 | 58 | 23 (11) | <1 | 16 |
| Smallmouth bass | 110 (21) | 2 | 75 | 13 (13) | <1 | 9 | <1 (<1) | <1 | <1 | 20 (5) | <1 | 13 | 2 (1) | <1 | 1 |
| Freshwater drum | 28 (9) | <1 | 21 | 5 (5) | <1 | 4 | 7 (5) | 26 | 5 | 9 (3) | <1 | 7 | 12 (6) | <1 | 9 |
| Pugnose minnow | 12 (3) | <1 | 12 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 3 (3) | <1 | 3 | 51 (14) | <1 | 50 |
| Common carp | 27 (24) | <1 | 28 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 3 (2) | <1 | 3 | 46 (29) | <1 | 47 |
| Speckled chub | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 6 (4) | 23 | 6 | 34 (32) | <1 | 37 | 51 (18) | <1 | 56 |
| Rock bass | 36 (7) | 1 | 40 | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 10 (3) | <1 | 11 | 7 (3) | <1 | 8 |
| Quillback | 10 (5) | <1 | 12 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 68 (31) | 1 | 84 | 2 (1) | <1 | 2 |
| Sauger | 25 (10) | <1 | 40 | 37 (37) | 1 | 60 | <1 (<1) | <1 | <1 | 6 (3) | <1 | 10 | 2 (2) | <1 | 4 |
| White crappie | 3 (1) | <1 | 9 | 2 (2) | <1 | 6 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | 7 (2) | <1 | 19 |
| Walleye | 13 (7) | <1 | 53 | 10 (10) | <1 | 39 | <1 (<1) | <1 | <1 | 3 (1) | <1 | 13 | 1 (1) | <1 | 5 |
| Smallmouth buffalo | 1 (1) | <1 | 4 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 3 | <1 (<1) | <1 | 1 |
| Channel catfish | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 12 (4) | 46 | 77 | <1 (<1) | <1 | 1 | 1 (1) | <1 | 9 |
| Northern pike | 2 (1) | <1 | 14 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 6 (4) | <1 | 42 | 4 (1) | <1 | 26 |
| Bigmouth buffalo | 1 (1) | <1 | 31 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 23 | 1 (1) | <1 | 38 |
| Flathead catfish | 1 (1) | <1 | 45 | <1 (<1) | <1 | <1 | 1 (<1) | 2 | 20 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 5 |
| Skipjack herring | <1 (<1) | <1 | 50 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 50 |
| Blue sucker | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 100 | <1 (<1) | <1 | <1 |
| Bighead carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Blue catfish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Goldeye | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Grass carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Lake sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Paddlefish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Shovelnose sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| All species | 6413 (1121) | 100 | 10 | 6326 (2394) | 100 | 10 | 25 (13) | 100 | <1 | 12017 (3218) | 100 | 19 | 36165 (17898) | 100 | 58 |

| | Fyke nets *N* = 32.3 (1.9) | | | Large hoop nets *N* = 55.4 (3.1) | | | Small hoop nets *N* = 55.4 (3.3) | | | Tandem fyke nets *N* = 26.4 (1.3) | | | Tandem mini fyke nets *N* = 26.6 (1.2) | | | All gears combined *N* = 384.7 (8.6) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | Percentage of this species in total annual catch |
| Emerald shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 173 (85) | 27 | <1 | 51984 (18989) | 83 |
| Gizzard shad | 20 (8) | 8 | 1 | <1 (<1) | 1 | <1 | <1 (<1) | <1 | <1 | 17 (7) | 4 | 1 | 32 (11) | 5 | 2 | 1998 (686) | 3 |
| Spotfin shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 9 (5) | 1 | 1 | 1841 (383) | 3 |
| Bluegill | 93 (28) | 38 | 7 | <1 (<1) | <1 | <1 | 5 (3) | 47 | <1 | 103 (43) | 25 | 8 | 100 (42) | 16 | 8 | 1311 (228) | 2 |
| Mimic shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 12 (8) | 2 | 1 | 949 (226) | 2 |
| Bullhead minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 35 (16) | 5 | 5 | 661 (193) | 1 |
| White bass | 31 (13) | 13 | 5 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 40 (17) | 10 | 6 | 24 (13) | 4 | 4 | 619 (272) | 1 |
| Black crappie | 74 (11) | 31 | 22 | <1 (<1) | 3 | <1 | <1 (<1) | 3 | <1 | 154 (34) | 37 | 45 | 36 (12) | 6 | 10 | 339 (65) | 1 |
| River shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 261 (61) | <1 |
| Largemouth bass | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 239 (43) | <1 |
| Logperch | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 16 (10) | 2 | 7 | 214 (52) | <1 |
| Spottail shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 42 (11) | 7 | 22 | 189 (43) | <1 |
| Yellow perch | 4 (4) | 2 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 5 (3) | 1 | 3 | 2 (1) | <1 | 1 | 160 (47) | <1 |
| Johnny darter | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 29 (17) | 4 | 20 | 147 (39) | <1 |
| Smallmouth bass | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 147 (27) | <1 |
| Freshwater drum | 6 (2) | 3 | 5 | <1 (<1) | <1 | <1 | <1 (<1) | 1 | <1 | 39 (18) | 9 | 29 | 30 (7) | 5 | 22 | 134 (23) | <1 |
| Pugnose minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 35 (13) | 5 | 35 | 101 (25) | <1 |
| Common carp | <1 (<1) | <1 | <1 | 13 (13) | 92 | 14 | <1 (<1) | 1 | <1 | <1 (<1) | <1 | <1 | 7 (6) | 1 | 7 | 97 (56) | <1 |
| Speckled chub | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 91 (29) | <1 |
| Rock bass | 9 (3) | 4 | 10 | <1 (<1) | 1 | <1 | 5 (3) | 44 | 6 | 17 (7) | 4 | 19 | 5 (2) | 1 | 5 | 90 (19) | <1 |
| Quillback | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 82 (36) | <1 |
| Sauger | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 3 | 62 (30) | <1 |
| White crappie | 1 (1) | 1 | 4 | <1 (<1) | 1 | <1 | <1 (<1) | 1 | <1 | 8 (3) | 2 | 21 | 16 (8) | 2 | 41 | 39 (9) | <1 |
| Walleye | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 2 | 25 (9) | <1 |
| Smallmouth buffalo | <1 (<1) | <1 | 1 | <1 (<1) | 1 | 1 | <1 (<1) | <1 | <1 | 22 (22) | 5 | 91 | <1 (<1) | <1 | 1 | 24 (24) | <1 |
| Channel catfish | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | 3 | 2 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 9 | 15 (4) | <1 |
| Northern pike | <1 (<1) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 3 | 2 (2) | <1 | 12 | 14 (8) | <1 |
| Bigmouth buffalo | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 8 | 4 (2) | <1 |
| Flathead catfish | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 30 | 3 (2) | <1 |
| Skipjack herring | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Blue sucker | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Bighead carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Blue catfish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Goldeye | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Grass carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Lake sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Paddlefish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Shovelnose sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| All species | 242 (29) | 100 | <1 | 14 (13) | 100 | <1 | 11 (4) | 100 | <1 | 413 (75) | 100 | 1 | 644 (114) | 100 | 1 | 62272 (18692) | 100 |

**Table E-2.** For Navigation Pool 8, mean annual catch of fish <120 mm in total length and variance (*in parentheses*) of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program (LTRMP) and the percentage of total annual catch accounted for by that species within a gear (a column) and across all gears (a row). "*N*" is the mean number of independent samples collected annually with one standard error (*in parentheses*). Species are listed in order of abundance in total annual catch for all gears combined. Only species comprising the top 99% of the total catch within Navigation Pool 8 are included, except that species of particular management interest that did not contribute to the top 99% are also included. Data were from stratified random sampling during 1993 through 1999 in the LTRMP Fish Component. (Shaded bars are added for readability.)

| | Day electrofishing *N* = 96.7 (2.3) | | | Night electrofishing *N* = 54.0 (0.0) | | | Bottom trawling *N* = 5.6 (1.7) | | | Seining *N* = 52.6 (10.6) | | | Mini fyke nets *N* = 83.0 (0.7) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears |
| Emerald shiner | 1753 (647) | 19 | 23 | 1444 (341) | 23 | 19 | <1 (<1) | <1 | <1 | 3399 (750) | 26 | 45 | 893 (346) | 11 | 12 |
| Spotfin shiner | 1349 (169) | 15 | 19 | 591 (132) | 9 | 8 | <1 (<1) | <1 | <1 | 3282 (438) | 25 | 46 | 1856 (461) | 22 | 26 |
| Bluegill | 1654 (372) | 18 | 31 | 630 (132) | 10 | 12 | <1 (<1) | <1 | <1 | 750 (140) | 6 | 14 | 1449 (302) | 17 | 27 |
| Bullhead minnow | 669 (187) | 7 | 22 | 339 (116) | 5 | 11 | <1 (<1) | <1 | <1 | 931 (329) | 7 | 31 | 981 (526) | 12 | 32 |
| Mimic shiner | 423 (245) | 5 | 14 | 673 (185) | 11 | 22 | <1 (<1) | <1 | <1 | 1456 (648) | 11 | 49 | 326 (132) | 4 | 11 |
| River shiner | 363 (39) | 4 | 14 | 551 (132) | 9 | 21 | <1 (<1) | <1 | <1 | 1229 (208) | 9 | 48 | 418 (137) | 5 | 16 |
| White bass | 114 (53) | 1 | 9 | 634 (231) | 10 | 48 | <1 (<1) | 2 | <1 | 156 (110) | 1 | 12 | 101 (31) | 1 | 8 |
| Gizzard shad | 607 (177) | 7 | 46 | 231 (68) | 4 | 18 | <1 (<1) | 1 | <1 | 301 (119) | 2 | 23 | 115 (67) | 1 | 9 |
| Pugnose minnow | 43 (10) | <1 | 3 | 18 (4) | <1 | 1 | <1 (<1) | <1 | <1 | 189 (38) | 1 | 15 | 706 (218) | 9 | 57 |
| Largemouth bass | 317 (76) | 3 | 49 | 57 (21) | 1 | 9 | <1 (<1) | <1 | <1 | 84 (28) | 1 | 13 | 183 (141) | 2 | 28 |
| Black crappie | 61 (14) | 1 | 11 | 27 (10) | <1 | 5 | <1 (<1) | <1 | <1 | 31 (8) | <1 | 5 | 88 (22) | 1 | 16 |
| Freshwater drum | 103 (65) | 1 | 19 | 136 (77) | 2 | 24 | 13 (5) | 58 | 2 | 101 (94) | 1 | 18 | 96 (66) | 1 | 17 |
| Logperch | 246 (76) | 3 | 47 | 86 (27) | 1 | 16 | <1 (<1) | <1 | <1 | 122 (70) | 1 | 23 | 55 (16) | 1 | 10 |
| Johnny darter | 141 (57) | 2 | 28 | 30 (9) | <1 | 6 | <1 (<1) | <1 | <1 | 193 (60) | 1 | 39 | 117 (30) | 1 | 24 |
| Spottail shiner | 81 (22) | 1 | 21 | 30 (7) | <1 | 8 | <1 (<1) | <1 | <1 | 113 (40) | 1 | 30 | 146 (53) | 2 | 38 |
| Smallmouth bass | 175 (39) | 2 | 46 | 176 (40) | 3 | 47 | <1 (<1) | <1 | <1 | 16 (4) | <1 | 4 | 9 (2) | <1 | 2 |
| Common carp | 68 (40) | 1 | 18 | 14 (9) | <1 | 4 | <1 (<1) | <1 | <1 | 40 (35) | <1 | 11 | 192 (79) | 2 | 51 |
| Orangespotted sunfish | 132 (56) | 1 | 35 | 77 (44) | 1 | 21 | <1 (<1) | <1 | <1 | 60 (29) | <1 | 16 | 67 (27) | 1 | 18 |
| Quillback | 57 (23) | 1 | 16 | 9 (5) | <1 | 3 | <1 (<1) | <1 | <1 | 237 (83) | 2 | 67 | 50 (20) | 1 | 14 |
| Shorthead redhorse | 146 (32) | 2 | 44 | 152 (49) | 2 | 45 | <1 (<1) | <1 | <1 | 17 (8) | <1 | 5 | 17 (6) | <1 | 5 |
| Brook silverside | 30 (7) | <1 | 9 | 65 (20) | 1 | 20 | <1 (<1) | <1 | <1 | 206 (67) | 2 | 64 | 21 (8) | <1 | 6 |
| Yellow perch | 149 (58) | 2 | 56 | 30 (10) | <1 | 11 | <1 (<1) | <1 | <1 | 56 (20) | <1 | 21 | 16 (6) | <1 | 6 |
| Rock bass | 102 (18) | 1 | 42 | 78 (16) | 1 | 32 | <1 (<1) | <1 | <1 | 24 (7) | <1 | 10 | 16 (4) | <1 | 6 |
| Golden shiner | 25 (6) | <1 | 21 | 3 (1) | <1 | 2 | <1 (<1) | <1 | <1 | 5 (1) | <1 | 4 | 86 (74) | 1 | 71 |
| Green sunfish | 69 (22) | 1 | 60 | 14 (4) | <1 | 12 | <1 (<1) | <1 | <1 | 4 (3) | <1 | 4 | 25 (10) | <1 | 22 |
| Silver redhorse | 48 (14) | 1 | 42 | 36 (11) | 1 | 31 | <1 (<1) | <1 | <1 | 16 (5) | <1 | 14 | 12 (5) | <1 | 11 |
| Western sand darter | 2 (1) | <1 | 2 | 22 (7) | <1 | 20 | <1 (<1) | 1 | <1 | 85 (25) | 1 | 77 | <1 (<1) | <1 | <1 |
| Pumpkinseed | 35 (13) | <1 | 32 | 4 (1) | <1 | 4 | <1 (<1) | <1 | <1 | 5 (3) | <1 | 4 | 32 (10) | <1 | 29 |
| Weed shiner | 8 (4) | <1 | 8 | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 28 (17) | <1 | 28 | 62 (40) | 1 | 62 |
| Sauger | 12 (4) | <1 | 12 | 74 (34) | 1 | 75 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 2 | 4 (3) | <1 | 4 |
| Smallmouth buffalo | 18 (16) | <1 | 20 | 16 (15) | <1 | 18 | <1 (<1) | <1 | <1 | 21 (21) | <1 | 23 | 30 (25) | <1 | 33 |
| Spotted sucker | 59 (16) | 1 | 71 | 3 (2) | <1 | 3 | <1 (<1) | <1 | <1 | 17 (14) | <1 | 20 | 4 (2) | <1 | 5 |
| Miss. silvery minnow | 22 (22) | <1 | 34 | 4 (2) | <1 | 6 | <1 (<1) | <1 | <1 | 39 (39) | <1 | 59 | 1 (1) | <1 | 2 |
| Walleye | 14 (6) | <1 | 22 | 30 (17) | <1 | 48 | <1 (<1) | <1 | <1 | 9 (3) | <1 | 15 | 2 (1) | <1 | 3 |
| Channel catfish | <1 (<1) | <1 | 2 | 1 (1) | <1 | 4 | 8 (2) | 37 | 61 | <1 (<1) | <1 | 2 | 2 (1) | <1 | 14 |
| White crappie | 1 (1) | <1 | 8 | <1 (<1) | <1 | 3 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 13 | 4 (2) | <1 | 32 |
| Northern pike | 3 (1) | <1 | 34 | 1 (1) | <1 | 12 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 12 | 4 (3) | <1 | 43 |
| Flathead catfish | <1 (<1) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 4 | 4 (2) | <1 | 62 |
| Bigmouth buffalo | 1 (1) | <1 | 25 | 1 (<1) | <1 | 17 | <1 (<1) | 1 | 5 | <1 (<1) | <1 | 13 | 1 (1) | <1 | 38 |
| Blue sucker | 1 (1) | <1 | 45 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 45 | <1 (<1) | <1 | 9 |
| Goldeye | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 50 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 50 | <1 (<1) | <1 | <1 |
| Skipjack herring | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 100 | <1 (<1) | <1 | <1 |
| Bighead carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Blue catfish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Grass carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Lake sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Paddlefish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Shovelnose sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| All species | 9153 (1439) | 100 | 23 | 6340 (1035) | 100 | 16 | 22 (6) | 100 | <1 | 13317 (1911) | 100 | 34 | 8285 (1542) | 100 | 21 |

| | Fyke nets *N* = 58.9 (1.1) | | | Large hoop nets *N* = 65.9 (0.1) | | | Small hoop nets *N* = 65.7 (0.2) | | | Tandem fyke nets *N* = 15.4 (1.2) | | | Tandem mini fyke nets *N* = 15.4 (1.2) | | | All gears combined *N* = 513.1 (8.3) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean annual catch (variance) | Percentage of annual catch: This gear | Percentage of annual catch: All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | Percentage of this species in total annual catch |
| Emerald shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 66 (26) | 5 | 1 | 7555 (1675) | 19 |
| Spotfin shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | 2 | <1 | <1 (<1) | <1 | <1 | 18 (10) | 1 | <1 | 7097 (996) | 18 |
| Bluegill | 339 (56) | 38 | 6 | <1 (<1) | 50 | <1 | 18 (7) | 62 | <1 | 104 (43) | 38 | 2 | 379 (139) | 28 | 7 | 5322 (774) | 13 |
| Bullhead minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 104 (53) | 8 | 3 | 3023 (775) | 8 |
| Mimic shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 113 (110) | 8 | 4 | 2990 (1035) | 8 |
| River shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (2) | <1 | <1 | 2563 (315) | 6 |
| White bass | 260 (234) | 29 | 20 | <1 (<1) | 17 | <1 | <1 (<1) | 1 | <1 | 24 (13) | 9 | 2 | 30 (18) | 2 | 2 | 1320 (620) | 3 |
| Gizzard shad | 23 (9) | 3 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 20 (15) | 7 | 2 | 18 (10) | 1 | 1 | 1316 (339) | 3 |
| Pugnose minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 289 (126) | 21 | 23 | 1246 (336) | 3 |
| Largemouth bass | 2 (1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 5 (2) | <1 | 1 | 648 (192) | 2 |
| Black crappie | 212 (23) | 24 | 38 | <1 (<1) | <1 | <1 | 6 (4) | 21 | 1 | 94 (28) | 34 | 17 | 46 (13) | 3 | 8 | 565 (65) | 1 |
| Freshwater drum | 10 (5) | 1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 19 (14) | 7 | 3 | 83 (66) | 6 | 15 | 555 (351) | 1 |
| Logperch | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 19 (13) | 1 | 4 | 526 (185) | 1 |
| Johnny darter | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 15 (7) | 1 | 3 | 496 (144) | 1 |
| Spottail shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 13 (4) | 1 | 3 | 383 (105) | 1 |
| Smallmouth bass | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 377 (77) | 1 |
| Common carp | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 60 (49) | 4 | 16 | 376 (172) | 1 |
| Orangespotted sunfish | 4 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 1 (<1) | 3 | <1 | 2 (1) | 1 | 1 | 30 (12) | 2 | 8 | 373 (126) | 1 |
| Quillback | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 355 (116) | 1 |
| Shorthead redhorse | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | 2 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 334 (83) | 1 |
| Brook silverside | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 323 (85) | 1 |
| Yellow perch | 2 (1) | <1 | 1 | <1 (<1) | 17 | <1 | <1 (<1) | <1 | <1 | 5 (5) | 2 | 2 | 11 (6) | 1 | 4 | 268 (97) | 1 |
| Rock bass | 15 (7) | 2 | 6 | <1 (<1) | <1 | <1 | 1 (<1) | 3 | <1 | 2 (1) | 1 | 1 | 4 (2) | <1 | 1 | 242 (40) | 1 |
| Golden shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 1 | 122 (71) | <1 |
| Green sunfish | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 115 (24) | <1 |
| Silver redhorse | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 114 (30) | <1 |
| Western sand darter | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 110 (26) | <1 |
| Pumpkinseed | 23 (7) | 3 | 21 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 5 (3) | 2 | 5 | 5 (2) | <1 | 4 | 110 (28) | <1 |
| Weed shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 100 (62) | <1 |
| Sauger | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (6) | <1 | 7 | 98 (45) | <1 |
| Smallmouth buffalo | 2 (2) | <1 | 3 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 1 | 3 (2) | <1 | 3 | 92 (61) | <1 |
| Spotted sucker | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 82 (15) | <1 |
| Miss. silvery minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 66 (64) | <1 |
| Walleye | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 8 (7) | 1 | 13 | 63 (28) | <1 |
| Channel catfish | <1 (<1) | <1 | <1 | <1 (<1) | 17 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 16 | 13 (2) | <1 |
| White crappie | 1 (1) | <1 | 10 | <1 (<1) | <1 | <1 | <1 (<1) | 1 | 3 | 1 (1) | <1 | 9 | 3 (1) | <1 | 21 | 12 (3) | <1 |
| Northern pike | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 10 (3) | <1 |
| Flathead catfish | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (2) | <1 | 32 | 7 (4) | <1 |
| Bigmouth buffalo | <1 (<1) | <1 | 4 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 3 (2) | <1 |
| Blue sucker | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (1) | <1 |
| Goldeye | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Skipjack herring | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 |
| Bighead carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Blue catfish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Grass carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Lake sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Paddlefish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Shovelnose sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| All species | 898 (234) | 100 | 2 | 1 (1) | 100 | <1 | 29 (7) | 100 | <1 | 273 (74) | 100 | 1 | 1356 (321) | 100 | 3 | 39675 (4570) | 100 |

**Table E-3.** For Navigation Pool 13, mean annual catch of fish <120 mm in total length and variance (*in parentheses*) of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program (LTRMP) and the percentage of total annual catch accounted for by that species within a gear (a column) and across all gears (a row). "*N*" is the mean number of independent samples collected annually with one standard error (*in parentheses*). Species are listed in order of abundance in total annual catch for all gears combined. Only species comprising the top 99% of the total catch within Navigation Pool 13 are included, except that species of particular management interest that did not contribute to the top 99% are also included. Data were from stratified random sampling during 1993 through 1999 in the LTRMP Fish Component. (Shaded bars are added for readability.)

| | Day electrofishing *N* = 60.1 (1.5) | | | Night electrofishing *N* = 21.6 (1.4) | | | Bottom trawling *N* = 5.4 (0.4) | | | Seining *N* = 52.0 (2.0) | | | Mini fyke nets *N* = 71.4 (2.8) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | |
| Species | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears |
| Emerald shiner | 876 (188) | 28 | 9 | 1050 (646) | 42 | 11 | <1 (<1) | <1 | <1 | 6209 (1758) | 32 | 64 | 1352 (448) | 15 | 14 |
| River shiner | 131 (25) | 4 | 2 | 80 (33) | 3 | 1 | <1 (<1) | <1 | <1 | 4492 (809) | 23 | 82 | 757 (321) | 8 | 14 |
| Bluegill | 564 (161) | 18 | 11 | 300 (83) | 12 | 6 | <1 (<1) | <1 | <1 | 1440 (439) | 7 | 27 | 2223 (566) | 25 | 42 |
| Channel shiner | 41 (19) | 1 | 1 | 75 (42) | 3 | 2 | <1 (<1) | 1 | <1 | 2034 (1568) | 10 | 59 | 1178 (787) | 13 | 34 |
| Freshwater drum | 85 (21) | 3 | 3 | 116 (37) | 5 | 4 | 20 (11) | 29 | 1 | 741 (690) | 4 | 22 | 1006 (838) | 11 | 30 |
| Gizzard shad | 585 (349) | 19 | 31 | 279 (208) | 11 | 15 | <1 (<1) | <1 | <1 | 545 (162) | 3 | 29 | 334 (197) | 4 | 18 |
| Bullhead minnow | 77 (21) | 2 | 7 | 48 (20) | 2 | 4 | <1 (<1) | <1 | <1 | 717 (190) | 4 | 64 | 170 (57) | 2 | 15 |
| Largemouth bass | 132 (29) | 4 | 14 | 38 (10) | 2 | 4 | <1 (<1) | <1 | <1 | 530 (390) | 3 | 54 | 272 (180) | 3 | 28 |
| Orangespotted sunfish | 121 (36) | 4 | 14 | 96 (31) | 4 | 11 | <1 (<1) | <1 | <1 | 243 (64) | 1 | 29 | 262 (100) | 3 | 31 |
| Mimic shiner | 29 (29) | 1 | 4 | 36 (36) | 1 | 4 | <1 (<1) | <1 | <1 | 516 (516) | 3 | 64 | 216 (216) | 2 | 27 |
| River carpsucker | 13 (9) | <1 | 2 | 30 (30) | 1 | 5 | <1 (<1) | <1 | <1 | 418 (203) | 2 | 63 | 189 (110) | 2 | 29 |
| White bass | 56 (16) | 2 | 10 | 122 (50) | 5 | 21 | <1 (<1) | <1 | <1 | 103 (24) | 1 | 18 | 222 (83) | 2 | 39 |
| Brook silverside | 18 (8) | 1 | 4 | 28 (13) | 1 | 6 | <1 (<1) | <1 | <1 | 373 (146) | 2 | 82 | 33 (16) | <1 | 7 |
| Common carp | 47 (32) | 2 | 13 | 13 (5) | 1 | 3 | <1 (<1) | <1 | <1 | 92 (43) | <1 | 25 | 138 (52) | 2 | 37 |
| Black crappie | 10 (5) | <1 | 3 | 4 (3) | <1 | 1 | <1 (<1) | <1 | <1 | 105 (84) | 1 | 29 | 40 (11) | <1 | 11 |
| Spotfin shiner | 57 (10) | 2 | 18 | 8 (2) | <1 | 3 | <1 (<1) | <1 | <1 | 186 (45) | 1 | 59 | 63 (16) | 1 | 20 |
| Pumpkinseed | 37 (9) | 1 | 12 | 11 (4) | <1 | 4 | <1 (<1) | <1 | <1 | 33 (14) | <1 | 11 | 102 (60) | 1 | 34 |
| Spottail shiner | 18 (4) | 1 | 8 | 5 (2) | <1 | 2 | <1 (<1) | <1 | <1 | 139 (109) | 1 | 62 | 49 (18) | 1 | 22 |
| Johnny darter | 4 (1) | <1 | 2 | 2 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 145 (64) | 1 | 75 | 39 (16) | <1 | 20 |
| Silver chub | 18 (7) | 1 | 12 | 41 (9) | 2 | 27 | 2 (1) | 2 | 1 | 72 (26) | <1 | 47 | 15 (7) | <1 | 10 |
| White crappie | 16 (5) | 1 | 11 | 5 (2) | <1 | 3 | <1 (<1) | <1 | <1 | 43 (32) | <1 | 31 | 37 (9) | <1 | 26 |
| River darter | 1 (1) | <1 | 1 | 1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 32 (14) | <1 | 25 | 86 (45) | 1 | 67 |
| Golden shiner | 36 (11) | 1 | 29 | 11 (6) | <1 | 9 | <1 (<1) | <1 | <1 | 19 (7) | <1 | 15 | 52 (18) | 1 | 42 |
| Channel catfish | 5 (1) | <1 | 4 | 9 (4) | <1 | 8 | 36 (21) | 54 | 31 | 29 (12) | <1 | 25 | 19 (6) | <1 | 16 |
| Logperch | 30 (7) | 1 | 28 | 15 (5) | 1 | 13 | <1 (<1) | <1 | <1 | 32 (9) | <1 | 29 | 22 (10) | <1 | 20 |
| Pugnose minnow | 2 (1) | <1 | 2 | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 14 (3) | <1 | 13 | 23 (4) | <1 | 22 |
| Tadpole madtom | 2 (1) | <1 | 2 | 1 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 46 (17) | <1 | 47 | 40 (18) | <1 | 42 |
| Shorthead redhorse | 18 (8) | 1 | 28 | 21 (7) | 1 | 32 | <1 (<1) | <1 | <1 | 18 (8) | <1 | 27 | 8 (4) | <1 | 13 |
| Mud darter | 3 (1) | <1 | 4 | 1 (1) | <1 | 2 | <1 (<1) | <1 | <1 | 32 (21) | <1 | 49 | 25 (13) | <1 | 39 |
| Smallmouth buffalo | 7 (6) | <1 | 12 | 9 (9) | <1 | 14 | <1 (<1) | <1 | <1 | 37 (25) | <1 | 59 | 5 (4) | <1 | 8 |
| Walleye | 8 (2) | <1 | 25 | 14 (4) | 1 | 45 | <1 (<1) | <1 | <1 | 5 (1) | <1 | 16 | 3 (1) | <1 | 9 |
| Sauger | 6 (3) | <1 | 44 | 7 (5) | <1 | 50 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 7 | 1 (<1) | <1 | 4 |
| Bigmouth buffalo | <1 (<1) | <1 | 6 | 1 (1) | <1 | 7 | <1 (<1) | <1 | <1 | 5 (5) | <1 | 67 | <1 (<1) | <1 | 6 |
| Flathead catfish | <1 (<1) | <1 | 4 | <1 (<1) | <1 | <1 | 2 (2) | 3 | 61 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 4 |
| Northern pike | <1 (<1) | <1 | 5 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 32 | 2 (1) | <1 | 58 |
| Shovelnose sturgeon | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 5 (5) | 7 | 100 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Blue sucker | <1 (<1) | <1 | 50 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Bighead carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Blue catfish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Goldeye | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Grass carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Lake sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Paddlefish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Skipjack herring | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| All species | 3092 (724) | 100 | 8 | 2516 (927) | 100 | 7 | 67 (24) | 100 | <1 | 19496 (2426) | 100 | 52 | 9023 (1339) | 100 | 24 |

| | Fyke nets *N* = 41.6 (0.4) | | | Large hoop nets *N* = 51.0 (2.0) | | | Small hoop nets *N* = 51.3 (2.0) | | | Tandem fyke nets *N* = 20.6 (0.4) | | | Tandem mini fyke nets *N* = 20.7 (0.3) | | | All gears combined *N* = 395.7 (13.0) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | |
| Species | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | Percentage of this species in total annual catch |
| Emerald shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 211 (78) | 8 | 2 | 9698 (2438) | 26 |
| River shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 12 (6) | <1 | <1 | 5472 (998) | 15 |
| Bluegill | 218 (47) | 48 | 4 | 7 (6) | 89 | <1 | 21 (2) | 46 | <1 | 111 (40) | 27 | 2 | 407 (155) | 16 | 8 | 5292 (848) | 14 |
| Channel shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 92 (77) | 4 | 3 | 3420 (2470) | 9 |
| Freshwater drum | 17 (11) | 4 | 1 | <1 (<1) | <1 | <1 | 8 (5) | 19 | <1 | 46 (16) | 11 | 1 | 1264 (1223) | 49 | 38 | 3300 (2816) | 9 |
| Gizzard shad | 50 (16) | 11 | 3 | <1 (<1) | <1 | <1 | <1 (<1) | 1 | <1 | 44 (18) | 11 | 2 | 51 (16) | 2 | 3 | 1889 (742) | 5 |
| Bullhead minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 111 (43) | 4 | 10 | 1123 (190) | 3 |
| Largemouth bass | 3 (1) | 1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 3 (1) | <1 | <1 | 979 (458) | 3 |
| Orangespotted sunfish | 7 (1) | 2 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | 1 | <1 | 11 (4) | 3 | 1 | 103 (51) | 4 | 12 | 843 (220) | 2 |
| Mimic shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 9 (9) | <1 | 1 | 805 (805) | 2 |
| River carpsucker | 8 (7) | 2 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 659 (335) | 2 |
| White bass | 14 (6) | 3 | 2 | <1 (<1) | <1 | <1 | 3 (3) | 6 | 1 | 31 (15) | 8 | 5 | 20 (10) | 1 | 3 | 569 (124) | 2 |
| Brook silverside | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 452 (169) | 1 |
| Common carp | 5 (4) | 1 | 1 | <1 (<1) | <1 | <1 | 3 (3) | 7 | 1 | 7 (5) | 2 | 2 | 72 (37) | 3 | 19 | 374 (144) | 1 |
| Black crappie | 59 (17) | 13 | 17 | <1 (<1) | <1 | <1 | 3 (2) | 8 | 1 | 90 (30) | 22 | 25 | 47 (27) | 2 | 13 | 358 (147) | 1 |
| Spotfin shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 315 (54) | 1 |
| Pumpkinseed | 56 (23) | 12 | 19 | <1 (<1) | 2 | <1 | <1 (<1) | 1 | <1 | 51 (11) | 13 | 17 | 8 (2) | <1 | 3 | 298 (98) | 1 |
| Spottail shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 15 (6) | 1 | 7 | 225 (105) | 1 |
| Johnny darter | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 4 (2) | <1 | 2 | 194 (81) | 1 |
| Silver chub | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 5 (2) | <1 | 3 | 151 (42) | <1 |
| White crappie | 9 (3) | 2 | 7 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 8 (3) | 2 | 6 | 23 (11) | 1 | 16 | 140 (51) | <1 |
| River darter | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 8 (4) | <1 | 6 | 129 (62) | <1 |
| Golden shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (2) | 1 | 2 | 6 (3) | <1 | 4 | 125 (39) | <1 |
| Channel catfish | 1 (1) | <1 | 1 | <1 (<1) | 4 | <1 | 4 (2) | 9 | 3 | 1 (<1) | <1 | <1 | 12 (8) | <1 | 11 | 116 (29) | <1 |
| Logperch | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 11 (5) | <1 | 10 | 109 (21) | <1 |
| Pugnose minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 66 (53) | 3 | 62 | 107 (57) | <1 |
| Tadpole madtom | <1 (<1) | <1 | <1 | <1 (<1) | 5 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (1) | <1 | 7 | 97 (24) | <1 |
| Shorthead redhorse | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 1 | 67 (20) | <1 |
| Mud darter | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 4 (2) | <1 | 6 | 65 (36) | <1 |
| Smallmouth buffalo | 3 (2) | 1 | 4 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (2) | <1 | 3 | 1 (1) | <1 | 1 | 63 (48) | <1 |
| Walleye | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 5 | 32 (5) | <1 |
| Sauger | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 2 | 14 (8) | <1 |
| Bigmouth buffalo | 1 (1) | <1 | 7 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 2 | <1 (<1) | <1 | 2 | <1 (<1) | <1 | 4 | 8 (7) | <1 |
| Flathead catfish | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | 1 | 9 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 22 | 3 (2) | <1 |
| Northern pike | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 5 | 3 (1) | <1 |
| Shovelnose sturgeon | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (2) | <1 |
| Blue sucker | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 50 | <1 (<1) | <1 |
| Bighead carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Blue catfish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Goldeye | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Grass carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Lake sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Paddlefish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Skipjack herring | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| All species | 453 (70) | 100 | 1 | 8 (6) | 100 | <1 | 45 (12) | 100 | <1 | 406 (45) | 100 | 1 | 2581 (1202) | 100 | 7 | 37687 (4437) | 100 |

**Table E-4.** For Navigation Pool 26, mean annual catch of fish <120 mm in total length and variance (*in parentheses*) of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program (LTRMP) and the percentage of total annual catch accounted for by that species within a gear (a column) and across all gears (a row). "*N*" is the mean number of independent samples collected annually with one standard error (*in parentheses*). Species are listed in order of abundance in total annual catch for all gears combined. Only species comprising the top 99% of the total catch within Navigation Pool 26 are included, except that species of particular management interest that did not contribute to the top 99% are also included. Data were from stratified random sampling during 1993 through 1999 in the LTRMP Fish Component. (Shaded bars are added for readability.)

| | Day electrofishing *N* = 70.7 (6.3) | | | Night electrofishing *N* = 6.0 (0.0) | | | Bottom trawling *N* = 3.0 (0.0) | | | Seining *N* = 35.1 (5.7) | | | Mini fyke nets *N* = 40.3 (4.6) | | | Fyke nets *N* = 22.0 (1.7) | | | Large hoop nets *N* = 50.0 (4.7) | | | Small hoop nets *N* = 50.1 (4.8) | | | Tandem fyke nets *N* = 11.0 (1.0) | | | Tandem mini fyke nets *N* = 11.0 (1.0) | | | All gears combined *N* = 298.0 (30.9) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | Percentage of annual catch | | | |
| Species | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | This gear | All gears | Mean annual catch (variance) | Percentage of this species in total annual catch |
| Gizzard shad | 2526 (672) | 57 | 38 | 108 (23) | 63 | 2 | <1 (<1) | 1 | <1 | 1354 (379) | 32 | 20 | 2268 (1102) | 36 | 34 | 17 (7) | 8 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 60 (18) | 28 | 1 | 413 (171) | 39 | 6 | 6716 (1601) | 40 |
| Emerald shiner | 373 (80) | 8 | 16 | 12 (3) | 7 | 1 | <1 (<1) | <1 | <1 | 1173 (332) | 28 | 51 | 650 (272) | 10 | 28 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 105 (43) | 10 | 5 | 2312 (592) | 14 |
| Channel shiner | 25 (11) | 1 | 2 | 5 (2) | 3 | <1 | <1 (<1) | <1 | <1 | 429 (195) | 10 | 32 | 889 (738) | 14 | 66 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 6 (3) | 1 | <1 | 1353 (921) | 8 |
| Freshwater drum | 152 (24) | 3 | 17 | 15 (2) | 8 | 2 | 54 (35) | 74 | 6 | 92 (64) | 2 | 10 | 410 (157) | 6 | 45 | 8 (6) | 4 | 1 | <1 (<1) | <1 | <1 | 1 (<1) | 2 | <1 | 29 (23) | 14 | 3 | 187 (44) | 18 | 20 | 919 (165) | 5 |
| River shiner | 37 (9) | 1 | 4 | 4 (2) | 2 | <1 | <1 (<1) | <1 | <1 | 667 (337) | 16 | 74 | 190 (155) | 3 | 21 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | <1 | 896 (477) | 5 |
| Western mosquitofish | 43 (27) | 1 | 5 | 1 (1) | <1 | <1 | <1 (<1) | <1 | <1 | 26 (12) | 1 | 3 | 808 (483) | 13 | 92 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 879 (491) | 5 |
| White bass | 143 (37) | 3 | 25 | 42 (15) | 24 | 7 | <1 (<1) | <1 | <1 | 83 (21) | 2 | 14 | 223 (111) | 4 | 39 | 28 (5) | 13 | 5 | <1 (<1) | <1 | <1 | <1 (<1) | 1 | <1 | 15 (4) | 7 | 3 | 68 (22) | 6 | 12 | 578 (189) | 3 |
| Bluegill | 294 (47) | 7 | 52 | 12 (4) | 7 | 2 | <1 (<1) | <1 | <1 | 7 (2) | <1 | 1 | 116 (39) | 2 | 20 | 88 (33) | 43 | 16 | <1 (<1) | <1 | <1 | 1 (1) | 4 | <1 | 18 (8) | 9 | 3 | 36 (13) | 3 | 6 | 568 (98) | 3 |
| Spotfin shiner | 38 (11) | 1 | 9 | 2 (1) | 1 | <1 | <1 (<1) | <1 | <1 | 143 (58) | 3 | 32 | 260 (131) | 4 | 59 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 443 (181) | 3 |
| Orangespotted sunfish | 267 (71) | 6 | 66 | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (2) | <1 | <1 | 58 (14) | 1 | 14 | 3 (1) | 1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 71 (33) | 7 | 18 | 402 (101) | 2 |
| Channel catfish | 78 (24) | 2 | 25 | 3 (2) | 2 | 1 | 17 (6) | 23 | 5 | 48 (16) | 1 | 15 | 74 (45) | 1 | 24 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 30 (27) | 87 | 10 | 3 (3) | 1 | 1 | 62 (44) | 6 | 20 | 312 (126) | 2 |
| Bullhead minnow | 70 (19) | 2 | 34 | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 22 (5) | 1 | 11 | 90 (24) | 1 | 43 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 26 (13) | 2 | 13 | 209 (46) | 1 |
| Black crappie | 11 (5) | <1 | 6 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 36 (8) | 1 | 19 | 53 (47) | 26 | 28 | <1 (<1) | <1 | <1 | 2 (2) | 6 | 1 | 78 (65) | 37 | 41 | 9 (5) | 1 | 5 | 190 (125) | 1 |
| Smallmouth buffalo | 74 (18) | 2 | 66 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 4 (1) | <1 | 4 | 23 (13) | <1 | 20 | 4 (3) | 2 | 3 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 8 (4) | 1 | 7 | 113 (32) | 1 |
| River carpsucker | 44 (10) | 1 | 42 | 1 (1) | 1 | 1 | <1 (<1) | <1 | <1 | 53 (17) | 1 | 50 | 5 (4) | <1 | 5 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 3 (2) | <1 | 2 | 104 (28) | 1 |
| Silverband shiner | 6 (2) | <1 | 8 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 9 (5) | <1 | 12 | 44 (23) | 1 | 61 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 14 (4) | 1 | 19 | 73 (22) | <1 |
| Common carp | 29 (11) | 1 | 42 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (5) | <1 | 10 | 19 (8) | <1 | 28 | 4 (4) | 2 | 6 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 1 | 9 (6) | 1 | 14 | 70 (22) | <1 |
| Skipjack herring | 42 (15) | 1 | 64 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 23 (12) | 1 | 34 | 1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 1 | 66 (21) | <1 |
| Red shiner | 4 (2) | <1 | 6 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 23 (10) | 1 | 37 | 35 (19) | 1 | 57 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 62 (24) | <1 |
| Bigmouth buffalo | 39 (36) | 1 | 71 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 16 (15) | <1 | 29 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 55 (51) | <1 |
| Silver chub | 13 (4) | <1 | 28 | 1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 16 (4) | <1 | 33 | 8 (4) | <1 | 16 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 10 (4) | 1 | 22 | 48 (12) | <1 |
| Miss. silvery minnow | 3 (2) | <1 | 8 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 6 (3) | <1 | 18 | 23 (14) | <1 | 74 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 31 (18) | <1 |
| White crappie | 4 (1) | <1 | 12 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 4 | 11 (3) | <1 | 36 | 2 (1) | 1 | 8 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 4 (2) | 2 | 14 | 9 (3) | 1 | 28 | 31 (4) | <1 |
| Brook silverside | 5 (2) | <1 | 17 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 20 (11) | <1 | 69 | 4 (2) | <1 | 12 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | 29 (14) | <1 |
| Largemouth bass | 16 (6) | <1 | 60 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 7 | 9 (3) | <1 | 33 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 27 (8) | <1 |
| Mooneye | 7 (6) | <1 | 27 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 16 (9) | <1 | 66 | 1 (1) | <1 | 6 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 2 | 25 (14) | <1 |
| Sauger | 13 (3) | <1 | 56 | 2 (2) | 1 | 8 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 5 | 6 (2) | <1 | 25 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 10 | 24 (5) | <1 |
| Goldeye | 17 (16) | <1 | 70 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (6) | <1 | 28 | <1 (<1) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 24 (23) | <1 |
| Shortnose gar | 2 (1) | <1 | 9 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 2 | 21 (8) | <1 | 89 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 24 (9) | <1 |
| Flathead catfish | 3 (1) | <1 | 69 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 12 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 4 | <1 (<1) | <1 | 9 | <1 (<1) | <1 | 8 | 4 (1) | <1 |
| Grass carp | <1 (<1) | <1 | 4 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 8 | 3 (3) | <1 | 88 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 3 (3) | <1 |
| Bighead carp | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 58 | 1 (<1) | <1 | 33 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 8 | 2 (1) | <1 |
| Blue catfish | <1 (<1) | <1 | 9 | <1 (<1) | <1 | <1 | 2 (1) | 3 | 91 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (1) | <1 |
| Walleye | 1 (1) | <1 | 45 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 9 | .1 (<1) | <1 | 45 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (1) | <1 |
| Blue sucker | <1 (<1) | <1 | 50 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 50 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (<1) | <1 |
| Lake sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Northern pike | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Paddlefish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Shovelnose | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| All species | 4439 (673) | 100 | 27 | 173 (28) | 100 | 1 | 73 (24) | 100 | <1 | 4247 (877) | 100 | 25 | 6343 (1525) | 100 | 38 | 207 (52) | 100 | 1 | <1 (<1) | 100 | <1 | 35 (26) | 100 | <1 | 213 (72) | 100 | 1 | 1055 (173) | 100 | 6 | 16739 (2391) | 100 |

**Table E-5**. For Open River, mean annual catch of fish <120 mm in total length and variance (*in parentheses*) of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program (LTRMP) and the percentage of total annual catch accounted for by that species within a gear (a column) and across all gears (a row). "*N*" is the mean number of independent samples collected annually with one standard error (*in parentheses*). Species are listed in order of abundance in total annual catch for all gears combined. Only species comprising the top 99% of the total catch within Open River are included, except that species of particular management interest that did not contribute to the top 99% are also included. Data were from stratified random sampling during 1993 through 1999 in the LTRMP Fish Component. (Shaded bars are added for readability.)

| Species | Day electrofishing *N* = 43.7 (5.1) Mean annual catch (variance) | Day electrofishing Percentage of annual catch: This gear | Day electrofishing Percentage of annual catch: All gears | Night electrofishing *N* = 0 Mean annual catch | Night electrofishing Percentage of annual catch: This gear | Night electrofishing Percentage of annual catch: All gears | Bottom trawling *N* = 16.5 (9.1) Mean annual catch (variance) | Bottom trawling Percentage of annual catch: This gear | Bottom trawling Percentage of annual catch: All gears | Seining *N* = 6.8 (1.2) Mean annual catch (variance) | Seining Percentage of annual catch: This gear | Seining Percentage of annual catch: All gears |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Freshwater drum | 65 (18) | 2 | 1 | – | – | – | 87 (40) | 48 | 2 | 8 (4) | 1 | <1 |
| Gizzard shad | 3067 (894) | 73 | 70 | – | – | – | 1 (1) | <1 | <1 | 281 (89) | 48 | 6 |
| Black crappie | 5 (2) | <1 | <1 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Channel shiner | 35 (18) | 1 | 5 | – | – | – | 20 (19) | 11 | 3 | 22 (15) | 4 | 3 |
| Emerald shiner | 177 (62) | 4 | 30 | – | – | – | <1 (<1) | <1 | <1 | 132 (72) | 22 | 22 |
| Bluegill | 83 (13) | 2 | 21 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| White bass | 50 (12) | 1 | 15 | – | – | – | <1 (<1) | <1 | <1 | 10 (4) | 2 | 3 |
| Red shiner | 173 (66) | 4 | 50 | – | – | – | <1 (<1) | <1 | <1 | 26 (14) | 4 | 7 |
| Channel catfish | 46 (14) | 1 | 18 | – | – | – | 50 (26) | 28 | 20 | 18 (5) | 3 | 7 |
| Goldeye | 216 (114) | 5 | 88 | – | – | – | <1 (<1) | <1 | <1 | 4 (3) | 1 | 2 |
| White crappie | 22 (13) | 1 | 16 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Silverband shiner | 16 (5) | <1 | 13 | – | – | – | 1 (1) | 1 | 1 | 6 (2) | 1 | 5 |
| River carpsucker | 12 (4) | <1 | 17 | – | – | – | <1 (<1) | <1 | <1 | 16 (10) | 3 | 21 |
| Common carp | 4 (2) | <1 | 5 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| River shiner | 17 (11) | <1 | 25 | – | – | – | <1 (<1) | <1 | <1 | 37 (17) | 6 | 54 |
| Orangespotted sunfish | 26 (13) | 1 | 49 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Miss. silvery minnow | 5 (3) | <1 | 11 | – | – | – | <1 (<1) | <1 | <1 | 13 (6) | 2 | 28 |
| Brook silverside | 30 (17) | 1 | 90 | – | – | – | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 1 |
| Spotted bass | 31 (13) | 1 | 91 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Green sunfish | 19 (12) | <1 | 59 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Threadfin shad | 17 (9) | <1 | 57 | – | – | – | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 2 |
| Western mosquitofish | 12 (8) | <1 | 42 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 |
| Silver chub | 6 (2) | <1 | 28 | – | – | – | <1 (<1) | <1 | 1 | 2 (1) | <1 | 9 |
| Bigmouth buffalo | <1 (<1) | <1 | <1 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Skipjack herring | 7 (4) | <1 | 45 | – | – | – | <1 (<1) | <1 | 1 | 4 (2) | 1 | 23 |
| Bullhead minnow | 2 (1) | <1 | 16 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Warmouth | 6 (4) | <1 | 41 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Sauger | 4 (2) | <1 | 29 | – | – | – | <1 (<1) | <1 | 1 | 2 (1) | <1 | 11 |
| Blue catfish | <1 (<1) | <1 | <1 | – | – | – | 10 (4) | 6 | 83 | 1 (1) | <1 | 7 |
| Speckled chub | 1 (<1) | <1 | 6 | – | – | – | 6 (4) | 3 | 47 | 1 (1) | <1 | 8 |
| Blacktail shiner | 4 (3) | <1 | 41 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Smallmouth buffalo | 2 (2) | <1 | 21 | – | – | – | <1 (<1) | <1 | <1 | 1 (1) | <1 | 5 |
| Bighead carp | 1 (1) | <1 | 6 | – | – | – | <1 (<1) | <1 | <1 | 1 (<1) | <1 | 7 |
| Flathead catfish | 5 (2) | <1 | 71 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Largemouth bass | 6 (5) | <1 | 94 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Blue sucker | <1 (<1) | <1 | 9 | – | – | – | <1 (<1) | <1 | 5 | <1 (<1) | <1 | <1 |
| Shovelnose sturgeon | <1 (<1) | <1 | <1 | – | – | – | 3 (2) | 2 | 83 | <1 (<1) | <1 | <1 |
| Paddlefish | <1 (<1) | <1 | <1 | – | – | – | 1 (1) | <1 | 85 | <1 (<1) | <1 | <1 |
| Grass carp | <1 (<1) | <1 | <1 | – | – | – | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 100 |
| Lake sturgeon | 0 (0) | 0 | 0 | – | – | – | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Northern pike | 0 (0) | 0 | 0 | – | – | – | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Silver carp | 0 (0) | 0 | 0 | – | – | – | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Walleye | 0 (0) | 0 | 0 | – | – | – | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| All species | 4204 (1036) | 100 | 31 | – | – | – | 180 (93) | 100 | 1 | 586 (121) | 100 | 4 |

| Species | Mini fyke nets *N* = 60.1 (4.8) Mean annual catch (variance) | Mini fyke nets Percentage of annual catch: This gear | Mini fyke nets Percentage of annual catch: All gears | Fyke nets *N* = 19.9 (1.2) Mean annual catch (variance) | Fyke nets Percentage of annual catch: This gear | Fyke nets Percentage of annual catch: All gears | Large hoop nets *N* = 51.1 (6.1) Mean annual catch (variance) | Large hoop nets Percentage of annual catch: This gear | Large hoop nets Percentage of annual catch: All gears | Small hoop nets *N* = 52.1 (6.3) Mean annual catch (variance) | Small hoop nets Percentage of annual catch: This gear | Small hoop nets Percentage of annual catch: All gears |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Freshwater drum | 4263 (1431) | 57 | 97 | 1 (1) | <1 | <1 | <1 (<1) | 50 | <1 | <1 (<1) | 2 | <1 |
| Gizzard shad | 897 (406) | 12 | 20 | 185 (178) | 13 | 4 | <1 (<1) | <1 | <1 | <1 (<1) | 1 | <1 |
| Black crappie | 61 (27) | 1 | 6 | 1003 (980) | 70 | 93 | <1 (<1) | <1 | <1 | 6 (6) | 44 | 1 |
| Channel shiner | 627 (325) | 8 | 90 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Emerald shiner | 297 (133) | 4 | 51 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Bluegill | 301 (126) | 4 | 76 | 9 (5) | 1 | 2 | <1 (<1) | <1 | <1 | 1 (1) | 10 | <1 |
| White bass | 106 (36) | 1 | 31 | 179 (174) | 13 | 52 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Red shiner | 148 (69) | 2 | 43 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Channel catfish | 143 (39) | 2 | 57 | 1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 4 (4) | 30 | 2 |
| Goldeye | 26 (12) | <1 | 11 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| White crappie | 81 (32) | 1 | 57 | 37 (31) | 3 | 26 | <1 (<1) | <1 | <1 | 1 (1) | 11 | 1 |
| Silverband shiner | 102 (37) | 1 | 83 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| River carpsucker | 48 (43) | 1 | 65 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Common carp | 69 (33) | 1 | 94 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| River shiner | 19 (8) | <1 | 28 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Orangespotted sunfish | 26 (10) | <1 | 47 | 2 (2) | <1 | 4 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Miss. silvery minnow | 31 (25) | <1 | 66 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Brook silverside | 3 (1) | <1 | 8 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Spotted bass | 3 (1) | <1 | 9 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Green sunfish | 7 (2) | <1 | 23 | 6 (6) | <1 | 18 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Threadfin shad | 12 (10) | <1 | 40 | <1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Western mosquitofish | 16 (4) | <1 | 57 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Silver chub | 15 (4) | <1 | 64 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Bigmouth buffalo | 19 (18) | <1 | 100 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Skipjack herring | 5 (2) | <1 | 34 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Bullhead minnow | 13 (5) | <1 | 84 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Warmouth | 9 (3) | <1 | 59 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Sauger | 9 (3) | <1 | 60 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Blue catfish | 3 (1) | <1 | 23 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Speckled chub | 6 (2) | <1 | 46 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Blacktail shiner | 6 (3) | <1 | 59 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Smallmouth buffalo | 1 (1) | <1 | 8 | 7 (7) | 1 | 76 | <1 (<1) | <1 | <1 | <1 (<1) | 1 | 2 |
| Bighead carp | 8 (4) | <1 | 87 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Flathead catfish | 2 (1) | <1 | 29 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Largemouth bass | <1 (<1) | <1 | 6 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Blue sucker | 3 (2) | <1 | 86 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Shovelnose sturgeon | 1 (<1) | <1 | 17 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Paddlefish | <1 (<1) | <1 | 15 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Grass carp | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 |
| Lake sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Northern pike | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Walleye | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| All species | 7437 (1614) | 100 | 54 | 1431 (1377) | 100 | 10 | <1 (<1) | 100 | <1 | 13 (7) | 100 | <1 |

| Species | Tandem fyke nets *N* = 0 Mean annual catch | Tandem fyke nets Percentage of annual catch: This gear | Tandem fyke nets Percentage of annual catch: All gears | Tandem mini fyke nets *N* = 0 Mean annual catch | Tandem mini fyke nets Percentage of annual catch: This gear | Tandem mini fyke nets Percentage of annual catch: All gears | All gears combined *N* = 247.0 (27.9) Mean annual catch (variance) | All gears combined Percentage of this species in total annual catch |
|---|---|---|---|---|---|---|---|---|
| Freshwater drum | – | – | – | – | – | – | 4411 (1460) | 32 |
| Gizzard shad | – | – | – | – | – | – | 4389 (1221) | 32 |
| Black crappie | – | – | – | – | – | – | 1075 (1004) | 8 |
| Channel shiner | – | – | – | – | – | – | 697 (352) | 5 |
| Emerald shiner | – | – | – | – | – | – | 586 (226) | 4 |
| Bluegill | – | – | – | – | – | – | 394 (138) | 3 |
| White bass | – | – | – | – | – | – | 344 (156) | 3 |
| Red shiner | – | – | – | – | – | – | 343 (104) | 2 |
| Channel catfish | – | – | – | – | – | – | 252 (50) | 2 |
| Goldeye | – | – | – | – | – | – | 247 (128) | 2 |
| White crappie | – | – | – | – | – | – | 143 (50) | 1 |
| Silverband shiner | – | – | – | – | – | – | 123 (43) | 1 |
| River carpsucker | – | – | – | – | – | – | 74 (55) | 1 |
| Common carp | – | – | – | – | – | – | 73 (34) | 1 |
| River shiner | – | – | – | – | – | – | 67 (19) | <1 |
| Orangespotted sunfish | – | – | – | – | – | – | 54 (22) | <1 |
| Miss. silvery minnow | – | – | – | – | – | – | 47 (29) | <1 |
| Brook silverside | – | – | – | – | – | – | 34 (17) | <1 |
| Spotted bass | – | – | – | – | – | – | 34 (14) | <1 |
| Green sunfish | – | – | – | – | – | – | 32 (19) | <1 |
| Threadfin shad | – | – | – | – | – | – | 29 (19) | <1 |
| Western mosquitofish | – | – | – | – | – | – | 28 (11) | <1 |
| Silver chub | – | – | – | – | – | – | 23 (5) | <1 |
| Bigmouth buffalo | – | – | – | – | – | – | 19 (18) | <1 |
| Skipjack herring | – | – | – | – | – | – | 16 (6) | <1 |
| Bullhead minnow | – | – | – | – | – | – | 15 (5) | <1 |
| Warmouth | – | – | – | – | – | – | 15 (5) | <1 |
| Sauger | – | – | – | – | – | – | 15 (4) | <1 |
| Blue catfish | – | – | – | – | – | – | 12 (4) | <1 |
| Speckled chub | – | – | – | – | – | – | 12 (5) | <1 |
| Blacktail shiner | – | – | – | – | – | – | 10 (4) | <1 |
| Smallmouth buffalo | – | – | – | – | – | – | 9 (6) | <1 |
| Bighead carp | – | – | – | – | – | – | 9 (5) | <1 |
| Flathead catfish | – | – | – | – | – | – | 7 (2) | <1 |
| Largemouth bass | – | – | – | – | – | – | 7 (5) | <1 |
| Blue sucker | – | – | – | – | – | – | 3 (2) | <1 |
| Shovelnose sturgeon | – | – | – | – | – | – | 2 (2) | <1 |
| Paddlefish | – | – | – | – | – | – | 1 (1) | <1 |
| Grass carp | – | – | – | – | – | – | <1 (<1) | <1 |
| Lake sturgeon | – | – | – | – | – | – | 0 (0) | 0 |
| Northern pike | – | – | – | – | – | – | 0 (0) | 0 |
| Silver carp | – | – | – | – | – | – | 0 (0) | 0 |
| Walleye | – | – | – | – | – | – | 0 (0) | 0 |
| All species | – | – | – | – | – | – | 13743 (1764) | 100 |

**Table E-6.** For La Grange Pool, mean annual catch of fish <120 mm in total length and variance (*in parentheses*) of catch for fish species collected in each gear used by the Long Term Resource Monitoring Program (LTRMP) and the percentage of total annual catch accounted for by that species within a gear (a column) and across all gears (a row). "*N*" is the mean number of independent samples collected annually with one standard error (*in parentheses*). Species are listed in order of abundance in total annual catch for all gears combined. Only species comprising the top 99% of the total catch within La Grange Pool are included, except that species of particular management interest that did not contribute to the top 99% are also included. Data were from stratified random sampling during 1993 through 1999 in the LTRMP Fish Component. (Shaded bars are added for readability.)

| | Day electrofishing *N* = 107.7 (10.8) | | | Night electrofishing *N* = 27.3 (7.6) | | | Bottom trawling *N* = 11.4 (0.4) | | | Seining *N* = 44.3 (2.5) | | | Mini fyke nets *N* = 82.7 (4.7) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean annual catch (variance) | Percentage of annual catch | | Mean annual catch (variance) | Percentage of annual catch | | Mean annual catch (variance) | Percentage of annual catch | | Mean annual catch (variance) | Percentage of annual catch | | Mean annual catch (variance) | Percentage of annual catch | |
| Species | | This gear | All gears | | This gear | All gears | | This gear | All gears | | This gear | All gears | | This gear | All gears |
| Gizzard shad | 15474 (5884) | 79 | 38 | 1654 (528) | 62 | 4 | 7 (7) | 11 | <1 | 4211 (1734) | 60 | 10 | 18064 (8238) | 62 | 45 |
| Emerald shiner | 696 (194) | 4 | 9 | 91 (29) | 3 | 1 | <1 (<1) | <1 | <1 | 1042 (230) | 15 | 14 | 5654 (1759) | 19 | 75 |
| Bluegill | 1042 (183) | 5 | 27 | 250 (113) | 9 | 6 | <1 (<1) | <1 | <1 | 271 (83) | 4 | 7 | 1533 (763) | 5 | 40 |
| White bass | 815 (177) | 4 | 27 | 314 (50) | 12 | 11 | <1 (<1) | 1 | <1 | 236 (124) | 3 | 8 | 912 (287) | 3 | 31 |
| Freshwater drum | 299 (69) | 2 | 11 | 150 (69) | 6 | 6 | 23 (8) | 36 | 1 | 91 (46) | 1 | 3 | 1443 (645) | 5 | 55 |
| Threadfin shad | 228 (85) | 1 | 39 | 17 (6) | 1 | 3 | <1 (<1) | 1 | <1 | 186 (134) | 3 | 32 | 74 (37) | <1 | 13 |
| Black crappie | 49 (17) | <1 | 9 | 20 (19) | 1 | 4 | <1 (<1) | <1 | <1 | 15 (6) | <1 | 3 | 121 (41) | <1 | 22 |
| Skipjack herring | 270 (173) | 1 | 71 | 7 (4) | <1 | 2 | <1 (<1) | <1 | <1 | 61 (45) | 1 | 16 | 8 (3) | <1 | 2 |
| Common carp | 115 (64) | 1 | 30 | 221 (193) | 8 | 59 | <1 (<1) | <1 | <1 | 11 (4) | <1 | 3 | 149 (92) | 1 | 40 |
| Western mosquitofish | 6 (3) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 205 (90) | 3 | 55 | 158 (109) | 1 | 43 |
| Largemouth bass | 151 (45) | 1 | 50 | 19 (9) | 1 | 6 | <1 (<1) | <1 | <1 | 73 (43) | 1 | 24 | 60 (15) | <1 | 20 |
| Channel catfish | 35 (10) | <1 | 14 | 9 (6) | <1 | 4 | 32 (8) | 51 | 13 | 19 (8) | <1 | 8 | 114 (38) | <1 | 47 |
| Bullhead minnow | 26 (9) | <1 | 12 | 2 (1) | <1 | 1 | <1 (<1) | <1 | <1 | 122 (35) | 2 | 56 | 63 (23) | <1 | 29 |
| White crappie | 31 (18) | <1 | 15 | 3 (3) | <1 | 1 | <1 (<1) | <1 | <1 | 15 (4) | <1 | 7 | 87 (32) | <1 | 41 |
| Smallmouth buffalo | 94 (39) | <1 | 47 | 13 (5) | <1 | 6 | <1 (<1) | <1 | <1 | 70 (48) | 1 | 35 | 13 (6) | <1 | 6 |
| Red shiner | 22 (7) | <1 | 13 | 8 (4) | <1 | 5 | <1 (<1) | <1 | <1 | 74 (33) | 1 | 43 | 67 (23) | <1 | 39 |
| Golden shiner | 19 (12) | <1 | 17 | 3 (1) | <1 | 2 | <1 (<1) | <1 | <1 | 38 (20) | 1 | 33 | 55 (34) | <1 | 47 |
| Brook silverside | 17 (6) | <1 | 20 | 7 (4) | <1 | 8 | <1 (<1) | <1 | <1 | 37 (9) | 1 | 42 | 26 (14) | <1 | 29 |
| Silverband shiner | 8 (5) | <1 | 11 | 2 (1) | <1 | 3 | <1 (<1) | <1 | <1 | 15 (8) | <1 | 21 | 46 (22) | <1 | 64 |
| Bluntnose minnow | 1 (1) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (3) | <1 | 10 | 60 (54) | <1 | 88 |
| Logperch | 12 (3) | <1 | 22 | 1 (<1) | <1 | 1 | <1 (<1) | <1 | <1 | 4 (2) | <1 | 7 | 39 (12) | <1 | 70 |
| Silver chub | 10 (3) | <1 | 19 | 1 (1) | <1 | 2 | <1 (<1) | 1 | 1 | 32 (14) | <1 | 59 | 10 (2) | <1 | 18 |
| Orangespotted sunfish | 19 (6) | <1 | 38 | 1 (1) | <1 | 3 | <1 (<1) | <1 | <1 | 6 (2) | <1 | 13 | 20 (5) | <1 | 40 |
| Sauger | 17 (5) | <1 | 35 | 3 (2) | <1 | 7 | <1 (<1) | <1 | <1 | 4 (1) | <1 | 8 | 22 (6) | <1 | 46 |
| Bigmouth buffalo | 14 (10) | <1 | 37 | 2 (1) | <1 | 4 | <1 (<1) | <1 | <1 | 15 (9) | <1 | 40 | 5 (3) | <1 | 14 |
| Grass carp | 1 (1) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 4 (4) | <1 | 12 | 28 (26) | <1 | 86 |
| Flathead catfish | <1 (<1) | <1 | 8 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 8 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 62 |
| Walleye | 1 (1) | <1 | 60 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 30 | <1 (<1) | <1 | 10 |
| Goldeye | 1 (1) | <1 | 89 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 11 | <1 (<1) | <1 | <1 |
| Bighead carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Blue catfish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Blue sucker | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Lake sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Northern pike | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Paddlefish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Shovelnose sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 |
| All species | 19580 (6248) | 100 | 31 | 2685 (489) | 100 | 4 | 63 (14) | 100 | <1 | 6962 (1903) | 100 | 11 | 29049 (9695) | 100 | 47 |

| | Fyke nets *N* = 36.6 (3.4) | | | Large hoop nets *N* = 61.6 (2.2) | | | Small hoop nets *N* = 62.3 (2.6) | | | Tandem fyke nets *N* = 14.6 (1.2) | | | Tandem mini fyke nets *N* = 14.6 (1.2) | | | All gears combined *N* = 463.0 (19.4) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean annual catch (variance) | Percentage of annual catch | | Mean annual catch (variance) | Percentage of annual catch | | Mean annual catch (variance) | Percentage of annual catch | | Mean annual catch (variance) | Percentage of annual catch | | Mean annual catch (variance) | Percentage of annual catch | | Mean annual catch (variance) | Percentage of this species in total annual catch |
| Species | | This gear | All gears | | This gear | All gears | | This gear | All gears | | This gear | All gears | | This gear | All gears | | |
| Gizzard shad | 162 (51) | 9 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | 1 | <1 | 267 (80) | 45 | 1 | 667 (306) | 43 | 2 | 40506 (14589) | 65 |
| Emerald shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 55 (40) | 4 | 1 | 7538 (2069) | 12 |
| Bluegill | 597 (116) | 34 | 15 | <1 (<1) | 50 | <1 | 9 (5) | 44 | <1 | 95 (34) | 16 | 2 | 72 (28) | 5 | 2 | 3870 (917) | 6 |
| White bass | 613 (240) | 35 | 20 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 51 (18) | 9 | 2 | 47 (20) | 3 | 2 | 2989 (623) | 5 |
| Freshwater drum | 38 (15) | 2 | 1 | <1 (<1) | 50 | <1 | 2 (1) | 12 | <1 | 25 (10) | 4 | 1 | 570 (273) | 37 | 22 | 2642 (783) | 4 |
| Threadfin shad | 23 (7) | 1 | 4 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 25 (18) | 4 | 4 | 31 (16) | 2 | 5 | 586 (233) | 1 |
| Black crappie | 254 (106) | 15 | 46 | <1 (<1) | <1 | <1 | <1 (<1) | 1 | <1 | 104 (72) | 18 | 19 | 7 (4) | <1 | 1 | 557 (182) | 1 |
| Skipjack herring | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 33 (29) | 2 | 9 | 379 (198) | 1 |
| Common carp | 1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | <1 | 7 (3) | <1 | 2 | 378 (129) | 1 |
| Western mosquitofish | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 369 (124) | 1 |
| Largemouth bass | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 304 (65) | <1 |
| Channel catfish | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 7 (4) | 35 | 3 | <1 (<1) | <1 | <1 | 26 (21) | 2 | 11 | 242 (56) | <1 |
| Bullhead minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 3 (1) | <1 | 1 | 217 (37) | <1 |
| White crappie | 41 (16) | 2 | 19 | <1 (<1) | <1 | <1 | 1 (1) | 6 | 1 | 41 (32) | 7 | 19 | 10 (6) | 1 | 5 | 210 (47) | <1 |
| Smallmouth buffalo | 6 (4) | <1 | 3 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 5 (3) | 1 | 2 | 3 (1) | <1 | 1 | 200 (54) | <1 |
| Red shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 171 (47) | <1 |
| Golden shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 117 (55) | <1 |
| Brook silverside | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 87 (20) | <1 |
| Silverband shiner | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | 72 (33) | <1 |
| Bluntnose minnow | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 68 (55) | <1 |
| Logperch | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 1 | 55 (13) | <1 |
| Silver chub | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 2 | 55 (14) | <1 |
| Orangespotted sunfish | 2 (1) | <1 | 5 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 1 | <1 (<1) | <1 | 1 | 50 (13) | <1 |
| Sauger | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 2 (1) | <1 | 5 | 48 (13) | <1 |
| Bigmouth buffalo | 1 (1) | <1 | 2 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 | 3 | 37 (16) | <1 |
| Grass carp | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 32 (31) | <1 |
| Flathead catfish | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | 1 | 8 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | 15 | 2 (1) | <1 |
| Walleye | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 |
| Goldeye | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | <1 (<1) | <1 | <1 | 1 (1) | <1 |
| Bighead carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Blue catfish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Blue sucker | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Lake sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Northern pike | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Paddlefish | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Shovelnose sturgeon | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| Silver carp | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 | 0 | 0 (0) | 0 |
| All species | 1741 (223) | 100 | 3 | <1 (<1) | 100 | <1 | 20 (7) | 100 | <1 | 589 (103) | 100 | 1 | 1548 (433) | 100 | 2 | 62238 (16672) | 100 |

| REPORT DOCUMENTATION PAGE | Form Approved OMB No. 0704-0188 |
|---|---|



| 1. AGENCY USE ONLY (Leave blank) | 2. REPORT DATE<br>September 2001 | 3. REPORT TYPE AND DATES COVERED |
|---|---|---|

4. TITLE AND SUBTITLE

Initial analyses of change detection capabilities and data redundancies in the Long Term Resource Monitoring Program

5. FUNDING NUMBERS

6. AUTHOR(S)

Kenneth Lubinski, Randy Burkhardt, Jennifer Sauer, David Soballe, and Yao Yin

7. PERFORMING ORGANIZATION NAME AND ADDRESS

U.S. Geological Survey
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Geological Survey
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

2001-T001

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Release unlimited. Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161 (1-800-553-6847 or 703-487-4650. Available to registered users from the Defense Technical Information Center, Attn: Help Desk, 8725 Kingman Road, Suite 0944, Fort Belvoir, VA 22060-6218 (1-800-225-3842 or 703-767-9050).

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

Evaluations of Long Term Resource Monitoring Program sampling designs for water quality, fish, aquatic vegetation, and macroinvertebrates were initiated in 1999 by analyzing data collected since 1992 in six trend analysis areas. Initial emphasis was placed on evaluating statistical power to detect change from one year or sampling interval to the next, and on determining what spatial, methodological, or target variable redundancies existed in the data sets. Power to detect change was evaluated at halved, present, and doubled levels of effort. Power to detect change for different variables varied widely and was greatly influenced by sample size and for species by their frequency of occurrence. Power for detecting annual and seasonal changes in most water-quality variables seems adequate. A doubling of effort would provide little increase in power, and some reduction or redistribution of effort may be possible. For fish, we could detect a 20% change (at $\alpha = 0.05$ and power of 0.7) in mean annual catch-per-unit-effort for 41 species in at least one trend analysis area. Doubling effort would not appreciably enhance power for rare species. Power for detecting change in aquatic vegetation seemed adequate. However, power for detecting change in macroinvertebrates was low, especially in Navigation Pool 26, the Open River, and La Grange Pool. Results of these analyses should provide useful information for evaluating the effects of potential changes to sampling designs.

14. SUBJECT TERMS

fish, invertebrates, Long Term Resource Monitoring Program, Mississippi River, monitoring, power analysis, sampling design, statistical analysis, vegetation, water quality

15. NUMBER OF PAGES

23 pp. + Appendixes A–E

16. PRICE CODE

| 17. SECURITY CLASSIFICATION OF REPORT | 18. SECURITY CLASSIFICATION OF THIS PAGE | 19. SECURITY CLASSIFICATION OF ABSTRACT | 20. LIMITATION OF ABSTRACT |
|---|---|---|---|
| Unclassified | Unclassified | Unclassified | |